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A New Species of *Breutelia* (Bartramiaceae) from Central America, with a Key to the Species of *Breutelia* in Central America

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ABSTRACT. *Breutelia pilifera* differs from all other species of *Breutelia* by its non-sheathing leaves that have costae excurrent into long, naked awns and reddish orange basal leaf cells across the leaf insertion. A key to the 14 species of *Breutelia* in Central America is given.

Breutelia is a robust genus found mostly at high elevations in the Neotropics. The genus has some distinctive, easy to recognize species, but most are taxonomically difficult. Two characters of critical taxonomic importance are leaf stance and the degree or type of alar region differentiation. Unfortunately, proper character-state evaluation of these features often requires previous familiarity with the genus. There are two basic leaf stances: spreading from the insertion and sheathing at the base. This leaf stance distinction is used in the beginning of many keys to the species of *Breutelia* (Bartram, 1949; Griffin, 1994; Churchill & Linares, 1995). It works tolerably well, but for some species it is difficult to evaluate because the two forms grade into one another and sometimes both can be found within single collections. Likewise, the degree or type of alar region differentiation, which often involves subtle distinctions, can be difficult to evaluate because of variation both within and among collections. Proper evaluation of this last feature requires the examination of many leaves.

Breutelia has an odd endostome structure that helps to bind the Bartramiaceae together. In those members of the family with a well-developed endostome the segments are broad and when examined with a hand lens appear to be positioned opposite to rather than alternating with the exostome teeth. Closer examination reveals each segment is split along the median line nearly to the basal membrane, and each half segment diverges outward toward the cilia where it often meets the diverging half segment of the next segment over, thus framing the cilia (see Fig. 1B). This endostome strucuture is sometimes inaccurately noted in the literature as "cilia cohering" (Zales, 1973); however, Shaw and Rohrer (1984) correctly evaluated the structure. Within the Bartramiaceae this type of endostome is found in *Bartramia*, *Breutelia*, *Philonotis*, and *Plagiopus*. Curiously, similar endostomial modification is found in the Bryaceae (*Acidodontium* and *Brachymenium columbicum* (De Notaris) Brotherus).

Breutelia is closely related to *Philonotis*, and although the two genera are generally easy to distinguish due to the larger size of *Breutelia*, technically they are difficult to separate. Sporophytically, the genera are identical; gametophytically, only the larger size, generally narrower and longer leaf cells, consistently plicate leaf bases, and differentiated alar cells of *Breutelia* separate the two genera. However, *Philonotis* approximates *Breutelia* in all of these features; even their size distinction is

blurred, since large plants of *Philonotis sphaericarpa* (Hedwig) Bridel and small plants of *Breutelia jamaicensis* (Mitten) A. Jaeger overlap in size.

There are 14 species of *Breutelia* in Central America, one of which is described below as new to science, in preparation for the next volume of the *Moss Flora of Central America* (Allen, 1994).

Breutelia pilifera B. H. Allen & D. G. Griffin, sp. nov. TYPE: Costa Rica. Cartago: Tapantí Forest Reserve ca. 25 km SE of Cartago, *Griffin & Eakin 196* (holotype, MO-4410818; isotypes, F, FLAS, NY, US). Figure 1A–H.

Species foliis habentibus aristis longis (0.6–0.8 mm) nudis a congeneribus differt.

Plants medium- to large-sized, yellowish green above, glossy, in loose tufts to 70 mm high. Stems red, in cross section hyalodermis present, central strand well developed; densely tomentose below, rhizoids reddish brown, smooth. Leaves 3–4 mm long, widely spaced, spreading from base, stiffly erect-incurved above, apices not twisted when dry, erect-spreading when wet, straight, occasionally falcate, ovate-lanceolate, long, slenderly acuminate, not or weakly plicate at base, not decurrent; margins plane to narrowly recurved at midleaf, serrulate; costa long excurrent into a long, naked awn, 0.6–0.8 mm long; leaf cells straight-walled, strongly papillose from the upper end, upper cells linear-elongate, firm-walled, 30–50 × 2.5–3.7 μm, lower cells linear-elongate, 55–75 × 2.5–3.7 μm, firm-walled; leaf base entirely orange to reddish yellow, alar region with small cluster (8–15) of enlarged, thin-walled cells at basal angle. Dioicous. Perigonia discoid. Setae flexuose, 25–30 mm long; capsules inclined, asymmetric, 2.5–3 mm long, subglobose, furrowed when dry, striate when wet, exothecial cells firm- to thick-walled, stomata immersed, numerous at base; operculum plano-convex; exostome teeth red, triangular, finely papillose below, coarsely papillose near tips, dorsal trabeculae faint, ventral trabeculae strongly thickened; endostome segments broad, yellow, papillose, segments split along the median line and each half diverging toward the cilia, cilia rudimentary 0–2. Spores reniform, 17–23 μm, faintly papillose, pale yellow.

Habitat. Lower montane rainforest, epilithic on wet rocky roadside embankment; 1000–1800 m.

Breutelia pilifera is a medium- to large-sized species known only from two collections, both made in the Tapantí Forest Reserve of Costa Rica. It has densely tomentose stems, a shiny, yellow-green color with widely spaced leaves that spread from the base and are stiffly erect-incurved above, which give the plants a "worm-like" aspect not seen in any other Central American species of *Breutelia.* Its most distinctive features are found in its costa, which is long excurrent into a naked awn, and its leaf base, which is orange or reddish yellow throughout. No other species of *Breutelia* has this combination of features. In Central America no other species has a costa as strongly excurrent as that of *B. pilifera.* The only other Central American species of *Breutelia* with an orange to reddish yellow leaf base is *B. reclinata* Brotherus. That species differs from *B. pilifera* in having much larger leaves (8–9 mm long) that are tightly sheathing at base, and a percurrent to shortly excurrent costa. The leaf cells of *B. pilifera* are straight-walled and very strongly papillose by projecting upper cell end-walls.

Breutelia pilifera differs from most members of *Breutelia* in having faintly papillose rather than warty-tuberculose spores. Faintly papillose spores are common in *Philonotis,* and the same spore ornamentation is found in *Breutelia jamaicensis,* which otherwise is distinctly philonotoid in aspect. Interestingly, however, *B. affinis* (Hooker) Mitten, another species with a philonotoid aspect, has warty spores.

The type of *B. pilifera* was originally distributed by the Moss Exchange of the American Bryological and Lichenological Society as *B. jamaicensis.* These specimens do not bear a collection number; instead, they have the herbarium number *019961.* The only type specimens we examined that have the collection number *196* are the holotype (MO) and one isotype (FLAS).

Paratype. COSTA RICA. **Cartago:** Reserva de Tapantí, *Gómez 18861* (CR, MO).

KEY TO THE SPECIES OF *BREUTELIA* IN CENTRAL AMERICA

1. Leaf base tightly sheathing 2
1′. Leaf loosely appressed or erect at base to widespreading from the insertion 6
2(1). Leaves to 9 mm long; orange at base; alar cells undifferentiated, consisting of elongate, porose cells . . . *B. reclinata* Brotherus
2′. Leaves to 7 mm long; hyaline at base, reddish orange only at insertion line; alar cells strongly differentiated or with at least 2–4 enlarged cells along the basal margin and a marginal row of enlarged rectangular cells 3
3(2). Alar cells greatly enlarged, thin-walled and bulging in 4–7 rows, extending nearly to leaf shoulders; leaf margins broadly revolute at shoulders; leaves without groups of short lax cells at top of basal plications . . . . . *B. inclinata* (Hampe & Lorentz) A. Jaeger

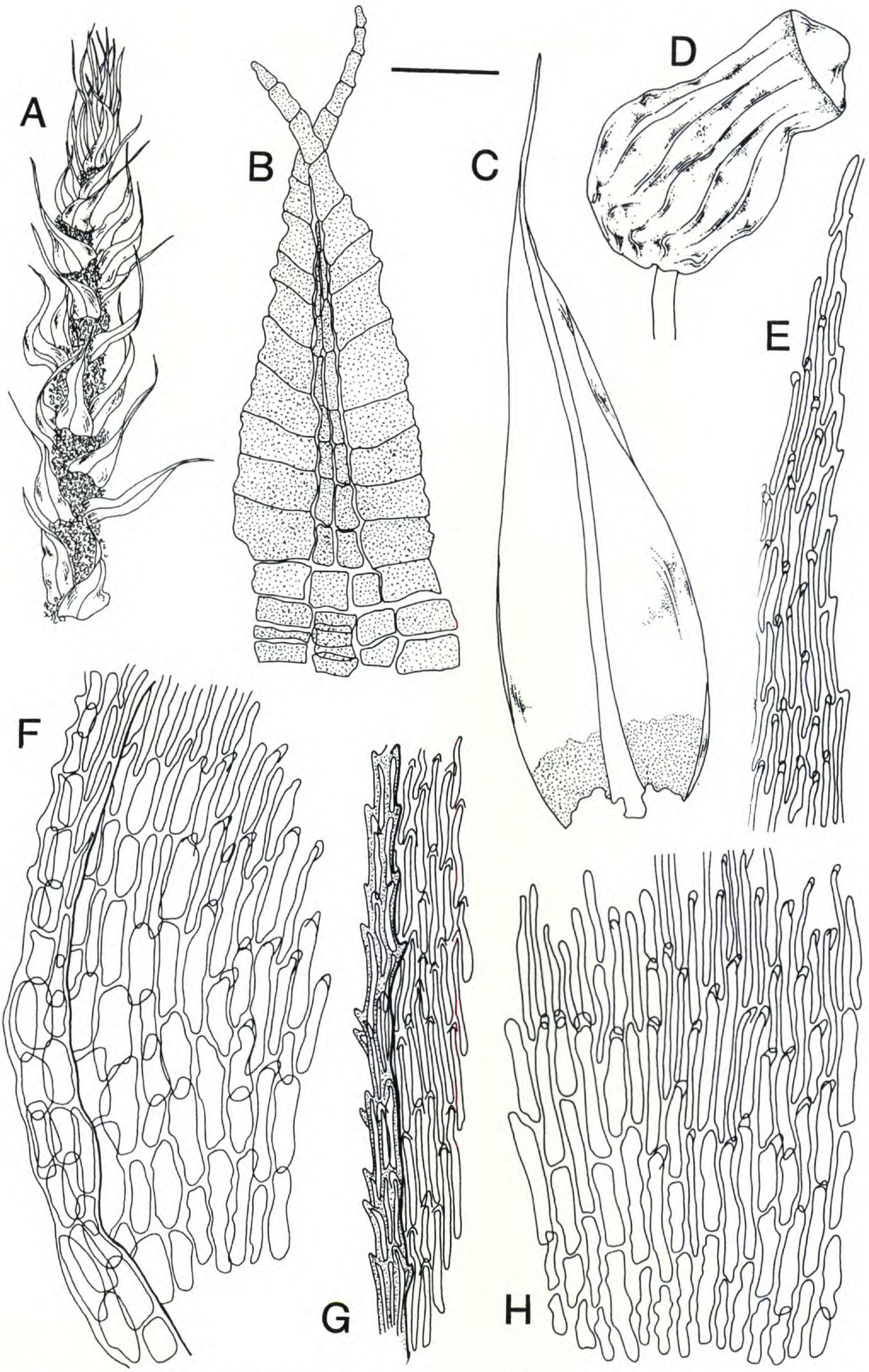

Figure 1. *Breutelia pilifera* B. H. Allen & D. G. Griffin. —A. Habit. —B. Part of the endostome ventral (inner) surface. —C. Leaf. —D. Capsule and operculum. —E. Upper leaf cells at margin. —F. Basal leaf cells in alar region. —G. Median leaf cells at margin. —H. Inner basal leaf cells near costa. Scale in mm: bar = 0.05 (E–H); bar = 0.1 (B); bar = 0.55 (C); bar = 1.3 (D); bar = 1.78 (A). All figures from *Griffin & Eakin 196* (MO).

3′. Alar cells somewhat enlarged, thin-walled to firm-walled; leaf margins plane or narrowly revolute; leaves often with groups of short lax cells at top of basal plications 4
4(3). Leaves erect-appressed to erect with divaricate tips when dry . . . . . *B. polygastrica* (Carl Müller) Brotherus
4′. Leaves squarrose, deflexed, or widespreading, never erect-appressed 5
5(4). Alar region with 4–6 rows of enlarged, lax, hyaline cells extending well up the leaf margin . . . . . *B. austro-arcuata* (Carl Müller) Paris
5′. Alar region with 2–4 enlarged cells along the basal margin and a marginal row of enlarged subrectangular to rectangular cells . . . . . *B. brittoniae* Renauld & Cardot
6(1). Costa excurrent into a long, naked, awn to 1 mm long; entire leaf base orange to reddish yellow . . . . . *B. pilifera* B. H. Allen & D. G. Griffin
6′. Costa percurrent or short excurrent; only the alar region and the area near the leaf insertion orange or reddish 7
7(6). Leaves erect-appressed; marginal basal cells quadrate in 5–10 rows, inner basal cells short-rectangular to quadrate . . . . . *B. jamaicensis* (Mitten) A. Jaeger
7′. Leaves spreading or erect at base, falcate or squarrose; marginal basal cells enlarged and lax, or undifferentiated, inner basal cells elongate 8
8(7). Leaves long decurrent; all basal leaf cells and decurrent cells lax and inflated; leaf margins plane . . . . . *B. auriculata* E. B. Bartram
8′. Leaves not decurrent, inner basal leaf cells long-rectangular to linear, firm to thick-walled, basal cells at margins lax and enlarged in 2–4 rows or firm to thick-walled and small; leaf margins recurved 9
9(8). Plants robust, leaves to 6–8 mm . . . . . *B. karsteniana* (Carl Müller) A. Jaeger
9′. Plants medium- to large-sized, leaves 3–5 mm long 10
10(9). Leaves ovate-lanceolate, smooth, gradually and evenly narrowed above to tip; caspules furrowed 11
10′. Leaves ovate to broadly lanceolate, smooth or rugose, abruptly narrowed above to tip; capsules rugulose to nearly smooth 12
11(10). Branch and stem leaves closely spaced, erect and overlapping at base, stems not evident; leaves with small group of enlarged cells at basal angles, and with enlarged cells extending up the basal margin . . . . . *B. chrysea* (Carl Müller) A. Jaeger
11′. Branch leaves (occasionally stem leaves) well spaced, spreading from the insertion, dark-red stems conspicuous; leaves with 1–2 enlarged cells at the extreme basal angles, otherwise alar cells undifferentiated . . . . . *B. tomentosa* (Swartz ex Bridel) A. Jaeger
12(10). Alar cells weakly differentiated, 1–3 inflated cells at extreme basal angles and a few enlarged supra-alar cells . . . . . *B. squarrosa* A. Jaeger
12′. Alar cells well differentiated, 4–9 rows of enlarged, firm-walled or inflated cells at basal angles, often extending up the basal margin in some leaves 13
13(12). Intramarginal alar cells non-porose, length to width 1–2:1 . . . . . *B. subarcuata* (Carl Müller) Schimper
13′. Intramarginal alar cells porose, length to width often more than 2:1 . . . . . *B. rhythidioides* Herzog

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Lepidium beckii (Brassicaceae), a New Species from Bolivia

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ABSTRACT. *Lepidium beckii*, a shrubby new species from Depto. La Paz (Bolivia), is described and illustrated. Its relationship to *L. philippianum* and *L. quitense* is discussed.

Of the world's ca. 180 species of *Lepidium* L., some 52 species are restricted to South America (Al-Shehbaz, 1993). All except two of the South American species are herbaceous. A third woody species, *L. beckii*, is described below, and the characters that distinguish it from the other two woody members, *L. quitense* Turczaninow and *L. philippianum* (Kuntze) Thellung, are discussed.

Lepidium beckii Al-Shehbaz, sp. nov. TYPE: Bolivia. La Paz: Prov. José Romá de Loayza, Baños Termales de Urmiri, matorral, 17°09′S, 68°05′W, 3500 m, 26 Jan. 1996, *St. G. Beck 21944* (holotype, MO; isotype, LPB). Figure 1.

Suffrutex omnino puberulus. Folia sessilia, anguste linearia, (0.5–)1–1.5(–2.5) cm longa, 0.5–1.2 mm lata. Flos sepalis oblongis, 1.7–2 mm longis, 0.9–1.1 mm latis, anguste membranaceo-marginatis; petalis albis, anguste oblanceolato-spathulatis, 2.5–3 mm longis, 0.5–0.7 mm latis; staminibus 4. Silicula oblonga vel ovato-oblonga, 4–5 mm longa, 3–3.5 mm lata, puberula; stylo persistente 0.5–0.7 mm longo.

Subshrubs, all parts except petals and filaments horizontally puberulent with trichomes 0.05–0.1 mm long. Stems 10–15 cm tall, woody along entire growth of previous years, 1–2 mm wide, slightly striate. Leaves all cauline, not forming rosettes, narrowly linear, (0.5–)1–1.5(–2.5) cm long, 0.5–1.2 mm wide, sessile, somewhat fleshy, entire, widest at or near base, acute at apex, often strongly concave adaxially, ascending to subappressed on stem, puberulent along both surfaces. Inflorescences few-flowered, ebracteate corymbose racemes, elongated in fruit. Fruiting pedicels flattened, ascending to divaricate, 3.5–5 mm long. Sepals oblong, ascending, 1.7–2 mm long, 0.9–1.1 mm wide, not saccate, membranous margin and apex 0.2–0.4 mm wide, apex obscurely denticulate. Petals white, narrowly oblanceolate-spatulate, 2.5–3 mm long, 0.5–0.7 mm wide, not clawed, gradually attenuate to base, apex obtuse. Stamens 4; filaments white, distinctly dilated at base, 2–2.6 mm long; anthers ovate, 0.5–0.6 mm long. Silicles oblong to ovate-oblong, 4–5 mm long, 3–3.5 mm wide; valves puberulent, keeled, not veined; apical notch 0.1–0.2 mm deep; style exserted from apical notch, 0.5–0.7 mm long, sparsely puberulent basally; stigma entire. Seeds reddish brown, oblong, ca. 2 × 1 mm; cotyledons accumbent.

Lepidium beckii, which is named in honor of Stephan G. Beck who made the type collection, is most closely related to the Ecuadorian *L. quitense* Turczaninow and the Chilean *L. philippianum* (Kuntze) Thellung, both of which have woody lower parts, four stamens, horizontally puberulent parts, and sessile, usually entire uppermost cauline leaves. The remaining South American species are herbs with two or rarely six stamens. From *Lepidium beckii*, *L. quitense* is readily distinguished by being a taller subshrub (20–50 cm) with many-flowered inflorescences, sepals ca. 1 mm long, petals shorter than sepals, glabrous fruits 2.5–3(–3.5) mm long, and shorter styles (0.1–0.3 mm long) included in the apical notch of the fruit. In contrast, *L. beckii* is a shorter plant (10–15 cm) with few-flowered inflorescences, sepals 1.7–2 mm long, petals longer than sepals, puberulent fruits 4–5 mm long, and longer styles (0.5–0.7 mm long) exserted from the apical notch of the fruit. *Lepidium philippianum* differs from *L. beckii* in having well-developed rosettes at the branches of the woody caudex, long petiolate basal leaves, apically toothed lower leaf blades (2–)3–5 mm wide, and glabrous fruits. *Lepidium beckii* does not produce basal rosettes, and it has sessile, entire leaves 0.5–1.2 mm wide and puberulent fruits. Furthermore, *L. philippianum* has a woody, much branched caudex, rather than being typical subshrubs as are *L. beckii* and *L. quitense*.

Hitchcock (1945) suggested that *Lepidium philippianum* is functionally dioecious, but I have not seen sufficient material to prove that, and no detailed field studies have been done on the species. I agree with Hitchcock that the division by Thellung (1906) of both *L. philippianum* and *L. quitense* into several varieties is unwarranted.

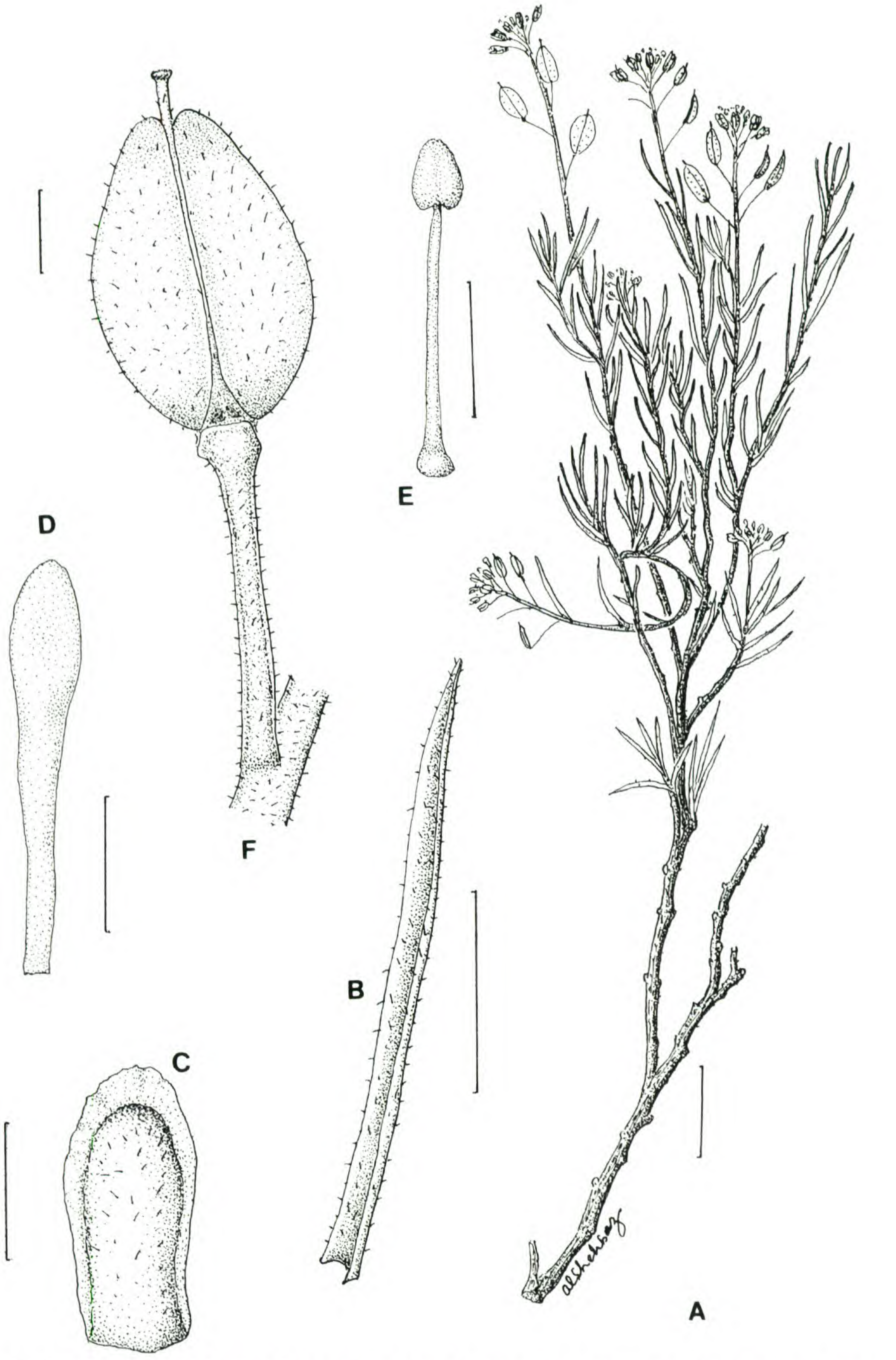

Figure 1. *Lepidium beckii* Al-Shehbaz (holotype). —A. Part of plant. —B. Cauline leaf. —C. Sepal. —D. Petal. —E. Stamen. —F. Fruit and pedicel. Scales A = 1 cm; B = 5 mm; C–F = 1 mm.

Acknowledgments. I am grateful to Stephan G. Beck for sending his Brassicaceae collections for my study and to Roy Gereau for correcting the Latin.

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A New Species of *Hemilophia* (Brassicaceae) from China

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ABSTRACT. *Hemilophia sessilifolia* is described and illustrated. Its relationship to the other species of *Hemilophia* is discussed.

The genus *Hemilophia* Franchet consists of three species, *H. pulchella* Franchet, *H. rockii* O. E. Schulz, and the new species *H. sessilifolia* Al-Shehbaz, Arai & H. Ohba, all endemic to southwestern Sichuan and adjacent Yunnan, China.

Hemilophia is readily distinguished from the related Chinese *Dipoma* Franchet by the appendaged and strongly inflated bases of the median staminal filaments, slender replum, entire leaves, and straight fruiting pedicels, and by lacking the fruit septum. *Dipoma* has slender filaments, strongly flattened replum, apically dentate leaves, strongly curved and loop-forming fruiting pedicels, and complete septum. *Hemilophia* is separated from the Himalayan and central Asian *Dilophia* Thomson by having slender rhizomes, appendaged and strongly inflated bases of the median staminal filaments, slender replum, and large (2–3 mm) seeds, 1 or 2 per fruit. *Dilophia* is a non-rhizomatous perennial with slender filaments, broadly winged replum, and small (ca. 1 mm) seeds, several per fruit.

The new species, *Hemilophia sessilifolia*, which is known only from the type collection, was collected during a recent Sino-Japanese expedition to Dauxue Shan, Yunnan.

Hemilophia sessilifolia Al-Shehbaz, Arai & H. Ohba, sp. nov. TYPE: China. Yunnan: Deqe, around Dauxue Shan, 28°34′N, 99°48′E, 4300–4550 m, 28 Aug. 1996, *Wu Sugong, Hiroshi Ikeda, Michio Wakabayashi, Futoshi Miyamoto, Yang Yongping & Takao Kikuchi 953* (holotype, TI; isotypes, KUN, MO). Figure 1.

Species ab *H. pulchella* Franchet et *H. rockii* O. E. Schulz foliis caulinis sessilibus, sepalis membranaceis integris facile cadentibus, petalis persistentibus, stylo glabro, et trichomatibus simplicibus obtecta bene differt.

Herbs perennial, rhizomatous. Rhizomes slender, not scaly. Stems 1 to several from basal rosette or solitary from rhizomes, 3–9 cm tall, simple or few-branched, with spreading to appressed simple trichomes 0.06–0.25 mm long. Basal leaves oblanceolate, 6–10 × 1.5–2.5 mm, dry at anthesis, densely beset with straight simple trichomes 0.8–1.3 mm long. Cauline leaves oblong to oblong-oblanceolate, 2.5–5(–8) × 1–2(–2.5) mm, sessile, entire, obtuse at apex, glabrous or minutely hairy as on stem. Inflorescences corymbose racemes, not elongated in fruit, bracteate throughout; bracts similar to cauline leaves. Sepals obovate, membranous, early caducous and leaving 4 receptacular teeth, not saccate, 1.8–2.7 × 1.2–1.5 mm, entire, rounded at apex. Petals persistent to fruit maturity, broadly obovate, 2-lobed, abruptly narrowed to claw, 6–7 × 4–5.5 mm, creamy white with dark green veins, pale to light brown at mouth, apical notch to 2 mm deep; claws 1.5–2.5 mm long. Filaments white; lateral filaments slender, unappendaged, 1.8–2.2 mm long; median filaments 1.9–2.5 mm long, basal half strongly inflated to form an oblong appendage 1.1–1.3 mm long; anthers green. Nectar glands surrounding base of lateral stamens, subtending base of median filaments. Fruiting pedicels slender, straight, divaricate, 5–6 mm long, pilose. Fruit oblong, dehiscent, glabrous; valves thin papery, navicular, 3–4 × 1.5–2 mm, with 3 rows of crests, 1 row on midvein and on either margin; replum slender, not flattened; septum absent; gynophore obsolete to 0.1 mm long; style glabrous, conical, 1–1.5 mm long; stigma entire. Seeds 1 or

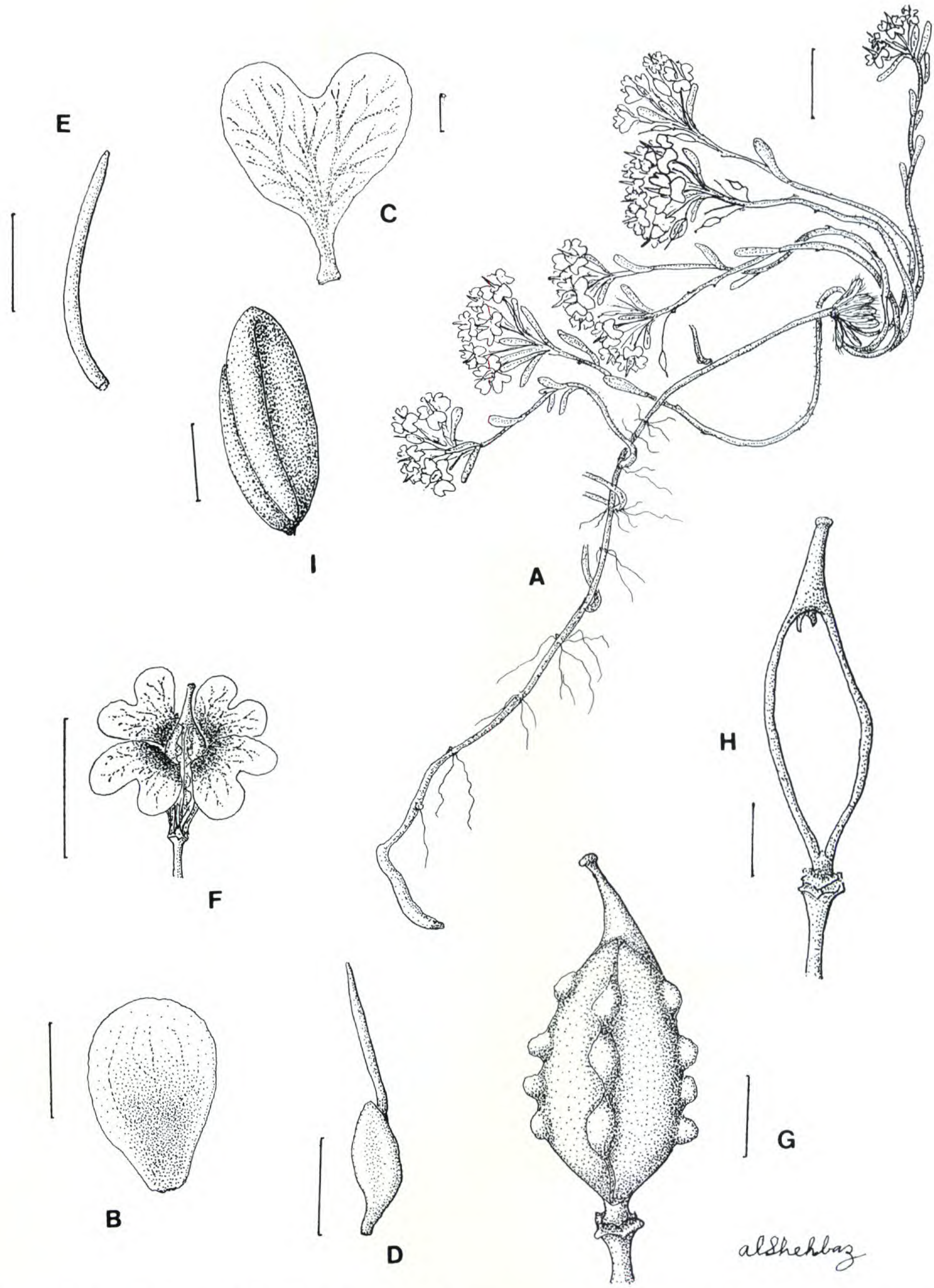

Figure 1. *Hemilophia sessilifolia* Al-Shehbaz, Arai & H. Ohba. —A. Plant. —B. Sepal. —C. Petal. —D. Median filament. —E. Lateral filament. —F. Fruit and persistent petals. —G. Fruit, dorsal view. —H. Fruit after removal of valves and seeds. —I. Seed. Scale bars: A = 1 cm; B–E, G–I = 1 mm; F = 5 mm. Drawn from the isotype at MO.

2 per fruit, oblong, 2.5–3 × 1.1–1.3 mm, smooth; cotyledons obliquely accumbent.

Hemilophia sessilifolia is readily distinguished from the two other species of the genus, *H. pulchella* and *H. rockii*, by the sessile cauline leaves, membranous, readily caducous entire sepals, persistent petals, glabrous conical style, and exclusively simple trichomes. Both *H. pulchella* and *H. rockii* have petiolate cauline leaves, green sepals that remain until fruit develops, caducous petals, a minutely papillose cylindric style, and 2-forked trichomes on the stem. *Hemilophia pulchella* is separated from *H. rockii* by having purplish petals 3–4 mm long instead of white petals 5–7 mm long, stem trichomes with long and straight instead of short and crisped rays, and an entire instead of ciliate sepal margin.

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Juncus anthelatus (Juncaceae, *Juncus* subg. *Poiophylli*), a New Status for a North American Taxon

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ABSTRACT. The taxon long known as *Juncus tenuis* Willdenow var. *anthelatus* Wiegand differs from *J. tenuis* in morphology (it is more robust than *J. tenuis*, with a more diffuse inflorescence and slightly smaller capsules), habitat, flowering time, and isozyme profile, and should be treated as a distinct species, *Juncus anthelatus* (Wiegand) R. E. Brooks, stat. nov.

Studies in *Juncus* subg. *Poiophylli* Buchenau in eastern North America (Brooks, 1989; Brooks & Clemants, in press) revealed that the entity formerly known as *Juncus tenuis* Willdenow var. *anthelatus* Wiegand is genetically distinct from *J. tenuis*, and should be considered a distinct species, *Juncus anthelatus*.

Juncus (subg. *Poiophylli*) **anthelatus** (Wiegand) R. E. Brooks, stat. nov. Basionym: *Juncus tenuis* Willdenow var. *anthelatus* Wiegand, Bull. Torrey Bot. Club 27: 523–524. 1900. *Juncus macer* Gray var. *anthelatus* (Wiegand) Fernald, J. Bot. 68: 367. 1930. TYPE: not designated.

Juncus macer Gray f. *discretiflorus* F. J. Hermann, Rhodora 40: 82. 1938. *Juncus tenuis* Willdenow f. *discretiflorus* (F. J. Hermann) Fernald, Rhodora 47: 123. 1945. TYPE: U.S.A. Indiana: Harrison County, 13 July 1935, *Deam 56381* (holotype, GH; isotype, IND).

Caespitose perennial herb from a branching rhizome. *Culms* erect, to (3–)7–9 dm tall. *Cataphylls* 1–2 per culm. *Leaves* basal, 2–3(–5) per culm; auricles 2–3.5 mm long, acutish, membranous; blades flat, (10–)20–30 cm × 0.5–2.3 mm. *Inflorescences* 10–100-flowered, diffuse, internodes of monochasia greater than 6 mm; primary bract usually exceeding inflorescence. *Flowers*: pedicels 0.1–0.3(–3) mm; bracteoles 2; tepals green, lanceolate, 3.2–4.5 × 0.7–1 mm, inner and outer series subequal, in fruit proximal part enfolding the capsule, apex erect; stamens 6, filaments 0.8–1.1 mm, anthers 0.3–0.7 mm; style ca. 0.2 mm. *Capsules* tan, 1-locular, widely ellipsoid to obovoid, 2–3.2 × 1.1–1.6 mm. *Seeds* tan, ellipsoid, 0.33–0.55 mm, untailed. Chromosome number: $2n = 80$.

Flowering and fruiting spring. Exposed or partially shaded sites in moist or seasonally wet, sandy or clay soils. Widespread in the eastern United States (Alabama, Arkansas, Connecticut, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Virginia, Vermont, Wisconsin).

Representative specimens examined. U.S.A. **Arkansas:** Logan Co., 8 Apr. 1985, *Teale s.n.* (KANU). **Georgia:** Pike Co., 7 Aug. 1985, *Brooks 17593 & Kuhn* (KANU). **Illinois:** Clark Co., 22 Aug. 1986, *Brooks 18547 & Kuhn* (KANU). **Kansas:** Leavenworth Co., 7 June 1985, *Brooks 17473a & Kuhn* (KANU). **Maine:** Penobscot Co., 6 Oct. 1932, *Ogden 599* (MAINE). **Massachusetts:** Hampshire Co., 28 Aug. 1976, *Ahles 82384* (VT). **Mississippi:** Hinds Co., 8 Aug. 1985, *Brooks 17627 & Kuhn* (KANU). **Missouri:** Camden Co., 26 May 1985, *Brooks 18135 & Kuhn* (KANU). **Ohio:** Lucas Co., 15 Oct. 1979, *Stuckey 10005* (OS). **Pennsylvania:** Adams Co., 8 Aug. 1986, *Brooks 18390* (KANU). **Tennessee:** Knox Co., *Kearney, Jr. s.n.* (OS). **West Virginia:** Fayette Co., 17 Aug. 1985, *Brooks 17962 & Kuhn* (KANU).

Juncus anthelatus tends to be more robust than *J. tenuis*, with a more diffuse inflorescence and slightly smaller capsules, and it often grows in wetter habitats than *J. tenuis*, though the two species are sometimes found growing in the same area. Although the two species can be difficult to distinguish morphologically, *J. anthelatus* flowers one to two weeks earlier than nearby populations of *J. tenuis*, both in the field and in the greenhouse, and the two species show consistent isozyme differences; *J. anthelatus* has a distinctive PGI-1 profile, which does not vary within or between populations across the range of the species (Brooks, 1989). Morphologically, the two species are best distinguished as follows:

1a. Capsules 2–3.2 mm long, less than ¾ as long as tepals, borne widely spaced along the usually diffuse branches of the inflorescence; culms (3–)7–9 dm tall . . . . . *Juncus anthelatus*

1b. Capsules (3.3–)3.8–4.7 mm long, ¾ or more as long as tepals, congested or the branch internodes about as long as the tepals; culms 1.5–5 dm tall . . . . . *Juncus tenuis*

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Two New Species of *Hoffmannia* (Rubiaceae) from Panama, with Remarks on Circumscription of Mesoamerican Species of the Genus

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ABSTRACT. The unusual degree of variation within *Hoffmannia* populations and the difficulty in clearly defining some Mesoamerican species are discussed. Two new species, *Hoffmannia dwyeri* and *H. fortunensis*, both endemic to the Chiriquí highlands, are described.

Having worked with *Hoffmannia* for the *Flora Costaricensis* series (Burger & Taylor, 1993), it seemed appropriate to expand that effort and treat the genus for the *Flora Mesoamericana* project. Work with the Costa Rican material had indicated that most species in the genus were very variable morphologically, and that making specific distinctions in some groups was extremely difficult or arbitrary. Unfortunately, studying over 3000 specimens of *Hoffmannia* in the region covered by the *Flora Mesoamericana* has made these difficulties abundantly clear.

While individuals of most plant species vary considerably, there are usually concordant suites of consistent morphological traits that allow us to identify and distinguish species from their close congeners. Floral dimensions and morphology are usually sufficiently constrained so that they are useful in characterizing species. Leaf dimensions may vary greatly, but leaf form and venation patterns are usually also helpful in identifying and distinguishing closely related species. Many species of *Hoffmannia*, however, exhibit a wider-than-normal range of variation in both floral dimensions, vesture, plant size, and leaf size and shape. This wider range of variation is rarely exhibited by any one plant; it becomes apparent only when a larger suite of collections is gathered together.

We use larger suites of collections to assess population variation, characterize species, determine species differences, delineate ranges, and look for local or regional differentiation. If we are able to effectively separate congeneric material into two closely related species, and then find that they consistently grow in different areas or slightly different habitats, we are reassured that they are indeed different species. If we find a few collections that are intermediate in a number of characteristics that distinguish two closely related species, both represented by large suites of collections, we may be confident that we have identified hybrids. If there are many intermediates between two distinctive morphological populations, we may be dealing with a cline or subspecific differentiation. In both these instances, however, we must first describe and characterize two different suites of character states, delimiting our species or subspecies. The problem in *Hoffmannia* is that the variation is often so great, and there is so little correlation between different characters, that delimiting two closely related "species" among a large suite of similar collections can be quite arbitrary. The only effective way to tackle this kind of problem is to separate out the most distinctive entities first, then try to tease out other distinctive taxa, before finally dealing with a large complex of similar specimens.

Clearly, one of the most easily distinguished species in the genus is *Hoffmannia vesiculifera* Standley, which has two inflated elongate vesicles along the lateral sides of the usually short petiole. *Hoffmannia kirkbridei* Dwyer also has such vesicles, but that species has very different petioles and leaf form, is known from only two collections, and may prove to be a variant of *H. vesiculifera*. Setting aside the two collections tentatively assigned to *H. kirkbridei*, and using the vesicles as a defining autapomorphy for *H. vesiculifera*, we can bring together a number of specimens that display a wide range of variation in both leaf and inflorescence characteristics. The plants themselves grow from 0.1 to 1.5 m in height when flowering, and range from central Costa Rica to central Panama. The inflorescences vary from sessile congested fascicles to pedunculate and distally branched paniculate forms. Leaves range from 10 to 30 cm in length and vary from elliptic to oblong or obovate. Calyx lobes may be 4–20 mm long; the corolla varies from about 10 to 20 mm in length. These extremes are never found on the same individual, and they do not characterize particular habitats, localities, or differing elevations. Rather, the extreme individuals appear

to be nothing more than unusual variants. Some of the more distinctive variants have been the basis for erecting new species, but all can be linked with the earliest type through intermediate collections. In the eastern part of this species' range, inflorescences are often borne on peduncles with small leaves at their apex (modified axillary branches). In the same area, there are plants with flowers densely crowded in the leaf axils, as in the type of *H. morii* Dwyer, based on *Mori & Kallunki 5915* (MO). At first, the two forms appear to be different species, but a larger series of specimens will include some with intermediate inflorescence characteristics. In short, *H. vesiculifera* appears to be a species easily identifiable by the petiolar vesicles, larger calyx lobes, generally short habit, and pubescence; but it is a species that varies rather dramatically in virtually all of its morphological features.

If we think of *H. vesiculifera* as being typical of *Hoffmannia* species, wide patterns of variation in other species of the genus become easier to understand. What gives us problems is the fact that these other species usually do not possess a similarly unique identifying trait. *Hoffmannia vesiculifera* and the poorly known *H. kirkbridei* Dwyer are the only species of the genus to have developed petiolar pouches large enough to house small ants. A number of species, such as the two new species being described below, do have a suite of distinctive traits and limited geographic range that make them relatively easy to recognize, but by the time we separate out such species we are left with wide-ranging taxa that may be catchalls for large numbers of similar-looking material.

Hoffmannia regalis (J. D. Hooker) Hemsley was based on horticultural material grown in Europe, and the name has been used for some wild collections from southern Mexico. The geographic origin of the original cultivated material was not known, but similar material of *Hoffmannia* is found only in Chiapas and Guatemala. The large leaves are occasionally broad and brilliantly colored with shades of purple beneath and a rich dark green above, the obvious reason for its introduction as a horticultural novelty. As in the case of *H. vesiculifera*, there is great variation in leaf size, shape, and coloring. Leaf bases, petioles, and inflorescences are also highly variable. The result of this extensive within-population variation is that there is no way to clearly separate those specimens that have in the past been identified as *Hoffmannia lineolata* J. Donn. Smith and *H. riparia* Standley. This latter material has been distinguished by its more often elliptic leaves with well-defined petioles and a lamina base that is not so long-decurrent. A large suite of collections makes it clear that these differences are bridged by many intermediates at all elevations. While the large, broad, brilliantly colored leaves are only found at elevations above 1200 m, there is sufficient variation at all elevations to make recognition of more than one species dubious.

Hoffmannia subauriculata Standley is quite distinctive because of its long-tapering lamina base and winged petioles, but it also exhibits considerable variation. The winged petioles are usually rounded and subauriculate at the stem, but not always. The plants are often short in stature with inflorescences usually borne at the lower leafless nodes, even at rooting nodes. The species ranges from Costa Rica to Colombia. Specimens from Darién, Panama, are distinctive because their consistently oblanceolate leaves tend to dry grayish, and their winged petioles are not auriculate at the base. Also the stems are often horizontal and rooting along the proximal nodes in eastern Panama. The name *H. eliasii* Dwyer would be appropriate if these plants of eastern Panama were to be separated from *H. subauriculata* as a distinct species, but it seems best to consider them part of a single variable species.

An extremely variable complex is found in the Chiriquí highlands of Panama, for which the name *H. pittieri* Standley has often been used. These populations may intergrade with material referable to the earlier named *H. arborescens* J. Donn. Smith of Costa Rica's Talamanca mountains. I have separated these collections by annotating those with usually axillary branched or cymose inflorescences as *H. arborescens*, and those in which the flowering inflorescences are simpler and largely confined to the lower leafless nodes as *H. pittieri*, consistent with the types. Unfortunately, there are intermediate collections both as regards their inflorescences and in other characteristics. It may be that this complex of forms should be further divided according to specific morphological traits, but I suspect that this is unrealistic. A closer examination of the populations in Chiriquí, and especially their cytology, might help unravel this problem. There is a report of within-species polyploidy in *Hoffmannia* (C. M. Taylor, pers. comm.), and this may be a factor in the variability found within the genus.

The most commonly collected species of *Hoffmannia* in Mexico and Central America is *H. nicotianifolia* (M. Martens & Galeoti) L. O. Williams. Based on material collected in Veracruz, Mexico, the name suggests plants with larger leaves. Among Veracruz collections there are large-leaved collections, a greater number of smaller-leaved collections, and some intermediates. Based on this vari-

ation in the region in which the earliest type was collected, I believe it is best to interpret *H. nicotianifolia* very broadly. However, adopting a broader interpretation can cause difficulty in dealing with distinctive variants that may be common in some geographical regions such as Honduras or Nicaragua.

A large percentage of *Hoffmannia* specimens from Nicaragua dry with a characteristic orange-brown or olive-green coloration and many have larger obovate to oblanceolate leaves. Their small flowers and short pedunculate inflorescences with thin pedicels clearly ally them with *H. nicotianifolia.* Because they are quite distinctive and characteristic of so much material from Nicaragua, they could be recognized as a separate species, first described by L. O. Williams as *H. oreophila.* However, with much variation and many intermediate collections, it seems best to include *H. oreophila* in a broad circumscription of *H. nicotianifolia.* This is consistent with also treating *H. angustifolia* Standley of Guatemala and Honduras as a synonym of *H. nicotianifolia.* After a review of many collections, I believe a broader, more inclusive species concept is justified, making *H. nicotianifolia* a species that ranges from northeastern Mexico to eastern Panama. However, larger circumscription does not eliminate the problem of having collections that appear to be intermediate with other closely related species. In the case of *H. nicotianifolia* there are collections that appear to be intermediate with *H. cryptoneura* Standley, *H. excelsa* (Kunth) K. Schumann, *H. hondurensis* Standley, *H. laxa* Standley, *H. oreophila, H. pittieri, H. psychotriifolia* (Bentham) Grisebach, *H. regalis,* and *H. steyermarkii* Standley. Whether any of the "intermediate" collections are true hybrid-like products of interspecific gene flow or simply variants with characteristics of one of the other species is difficult to determine.

Hoffmannia psychotriifolia is quite similar to *H. nicotianifolia* but differs from the latter by the usually longer corolla and by the consistently sessile inflorescences. The two are sometimes collected together. The names *Hoffmannia rotundata* Standley (holotype: *Purpus 7268,* MO) and *H. chiapensis* Standley (holotype: *Purpus 7268,* US) were based on a collection that Standley recognized as mixed. All the herbarium sheets seen have some elements of the two similar species. Having reviewed the descriptions and examined sheets from F, US, and MO, it appears that *H. rotundata* is a synonym of *H. nicotianifolia* in a wide sense, while *H. chiapensis* is a synonym of *H. psychotriifolia.* The type sheets and their respective parts have been annotated accordingly.

In central Panama there are specimens of *Hoffmannia nicotianifolia* with more ovate leaves that have been identified as *H. cercidifolia* Dwyer by Dwyer. However, the type of *H. cercidifolia* (*Duke 15597 (2),* MO) was collected in Darién and appears to represent a different species. Unfortunately, the type has only a few subsessile immature flowers and provides insufficient information to come to any firm conclusion regarding its placement. In addition, there are no similar collections from Darién to give us a better idea of the population that this collection represents. It seems likely that the type of *H. cercidifolia* may prove to be an unusual collection of an earlier named South American species, but it will require better sampling of the Darién populations before that likelihood can be verified.

At present a draft treatment of *Hoffmannia* for the *Flora Mesoamericana* includes 49 species. Having accepted many broader species concepts, I have also tended to tentatively place unusual collections within a related described species rather than erect new names. However, two small groups of collections from the Chiriquí highlands appear to represent two new and distinctive species.

Hoffmannia dwyeri W. Burger, sp. nov. TYPE: Panama. Chiriquí: vicinity of Boquete, Cerro Pate de Macho, SW slope, 8°46′N, 82°25′W, 1800–1950 m, 19 June 1987, *Croat 66403* (holotype, MO; isotype, F). Figure 1.

Species habitu cum *Hoffmannia valerii* Standley optime congruens, sed differt corollis longioribus, foliis basi cuneatis, petiolis alatis, stigmatibus latis, habitatione altitudo alta (1700–2100 m).

Herbs 0.2–0.8 m tall, leafy stems terete, 2–6 mm thick, subglabrous to villous with reddish brown hairs 0.5–2 mm long; stipules 1–3 mm long, thin, deciduous. Leaves opposite, subglabrous to villous, lamina obovate to elliptic-obovate or narrowly obovate, 7–23 × 3–9 cm, base cuneate and decurrent to form a wing along the petiole, attenuate or abruptly rounded and subauriculate at the base, apex acute to acuminate, 2° veins 6–12 pairs; petioles 2–12 mm long. Inflorescences axillary, 2–6 per node, 2–5 cm long, flowers in a close cymose grouping or paniculate, peduncle 10–27 mm long, villous to subglabrous. Flowers on pedicels 1–4 mm long, hypanthium 2–4 mm long, villous with hairs 1–2 mm long, calyx lobes 2–4 mm long, narrowly triangular; corolla funnelform, 8–16 mm long, white with pink tips to pinkish red, with few distal tri-

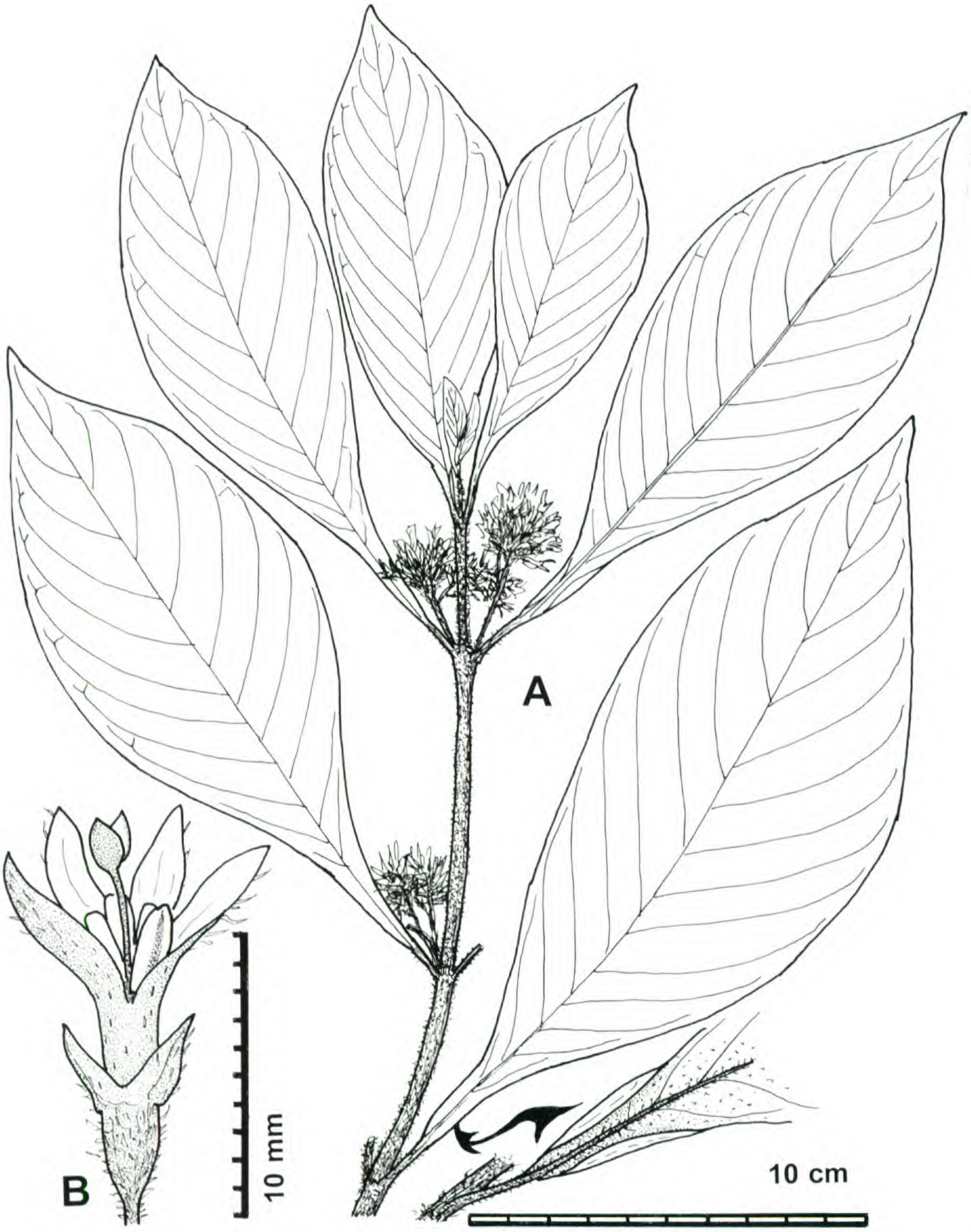

Figure 1. *Hoffmannia dwyeri* W. Burger. —A. Flowering stem. —B. Flower. A based on *Hammel 7412* (F) and *Sytsma et al. 4836* (MO); B from *Hammel 7412* (MO).

chomes, tube 4–5 mm long; anthers ca. 3.2 mm long, subsessile; style ca. 9 mm long, stigma ca. 3 mm long, broadly ovate. Fruits oblong, 8–9 mm long, 5–6 mm thick, pink to red-magenta, spongy, seeds blue.

Hoffmannia dwyeri has an unusual characteristic: the leaf base is cuneate-decurrent and the winged margins are often revolute near the base, forming a partly enclosed space abaxially. Its short herbaceous habit, long reddish brown multicellular hairs (when present), short densely flowered inflorescences, prominent calyx lobes, relatively large corolla, and broad stigmatic lobes are additional distinguishing features. Pubescence and floral morphology are similar to *H. valerii* Standley, but that species differs in the form of the lamina base and petiole, and its lower elevation habitat. The new species has only been collected around the Cerro de Pate Macho and upper headwaters of Río Palo Alto, between 1700 and 2100 m elevation. It flowers in March–June.

John Dwyer, who studied *Hoffmannia* intensively over more than 20 years, recognized material of this species as new in two of his annotations but did not publish either of the names. Because Dwyer's

(1969, 1980) publications and many identifications have been so helpful to all those working with this very difficult genus, it seems especially fitting that a distinctive species should bear his name.

Paratypes. PANAMA. **Chiriquí:** vicinity of Boquete; Cerro Pate de Macho, SW slope, 1800–1950 m, 19 June 1987, *Croat 66403* (MO); Río Palo Alto road to Chiriquí border with Bocas del Toro Province near peak of Cerro Pate Macho, 6200 ft., 20 Nov. 1978, *Hammel 5814* (MO); end of road past Palo Alto to Bocas, 6200 ft., 18 Mar. 1979, *Hammel 6510* (MO); Palo Alto, 4.5 mi. NE of Boquete, forest along western branch of headwaters of Río Palo Alto, 6300 ft., 24 May 1979, *Hammel 7412* (MO); S slopes of Cerro Pate Macho along Río Palo Alto, 1300–1800 m, 11 Nov. 1981, *Knapp et al. 2083* (MO); trail to Cerro Pate Macho, above Palo Alto, 1700–2100 m, 15 Mar. 1982, *Knapp et al. 4249* (MO); SE slopes and summit of Cerro Pate Macho, 4 km NE of Boquete, 1700–2100 m, 26 May 1981, *Systma et al. 4836* (MO).

Hoffmannia fortunensis Dwyer ex W. Burger, sp. nov. TYPE: Panama. Chiriquí: S.O. del campamento de Fortuna (Hornito), sitio de presa subiendo hasta la finca Pittí, 1000–1200 m, 14 ago. 1976, *M. D. Correa, R. Dressler & C. Garibaldi 2415* (holotype, PMA not seen; isotypes, F, MO).

Suffrutices ad 2 m alti, caulibus teretibus, glabris. Folia ad 23 cm longa, lamina anguste lanceolata, glabra, in sicco discolor, venis lateralibus 9–15 paribus. Inflorescentiae brevi. Flores glabri, lobis calycis brevibus, corollis 4–7 mm longis. Fructus maturi non visi.

Slender shrubs 0.5–2 m tall, leafy stems 2–7 mm thick, terete, glabrous. Leaves opposite, blades 11–23 cm long, 1.5–8 cm wide, linear-lanceolate to narrowly ovate-elliptic or elliptic-oblong, chartaceous, dark above, grayish beneath, glabrous, base cuneate and decurrent, apex acute to acuminate, 2° veins 9–15 pairs, loop-connected along the margin, petioles 15–65 mm long. Inflorescences 1–3 per axil, at lower or leafless nodes, racemose, 3–9 cm long, glabrous, drying dark, peduncles 2–4 cm, 0.3–0.4 mm thick. Flowers glabrous, pedicels to 10 mm long, hypanthium 2–3 mm long, calyx lobes 0.2–0.5 mm long, corolla 4–7 mm long, pale green or reddish green, corolla tube 1.5–2 mm long; anthers 2.5 mm long. Mature fruits not seen.

The usually long petioles and very narrow leaves with clearly demarked loop-connected secondary veins close to the lamina margins are distinctive features. In addition, the leaves often dry very dark above and grayish beneath. Slender racemose inflorescences with a single rachis drying dark, small flowers, and restriction to the Fortuna area of the Chiriquí highlands between 1000 and 1500 m elevation are additional distinctions. This species appears to be related to *Hoffmannia laxa* Standley, with which it shares the slender glabrous inflorescences and small flowers. There may be lower-elevation collections that have a few characteristics of both species, such as *von Wedel 2363* (MO).

Paratypes. PANAMA. **Chiriquí:** vicinity of Gualca 11 mi. from Planes de Hornito, La Fortuna on road to dam site, elev. 4000 ft., 9 July 1980, *Antonio 5050* (MO); N.O. del Campamento Fortuna (Hornito), 1000–1200 m, 16 ago. 1976, *Correa et al. 2515* (MO); Fortuna dam site, forest area, 1400–1600 m, 15 Sep. 1977, *Folsom et al. 5568* (MO); near site of dam, lower slopes of Cerro Fortuna, 1150 m, 18 June 1982, *Knapp & Vodicka 5584* (MO).

Acknowledgments. David Lorence kindly provided me with information relating to *Hoffmannia* from his draft manuscript "Nomenclator of Mexican and Central American Rubiaceae," which was very helpful. Mireya Correa verified that her collection *2415*, the designated holotype for *H. fortunensis*, was present at PMA. David Lorence and Charlotte Taylor provided helpful suggestions for revision of the manuscript. I am grateful to the curators of the following herbaria for making their collections available for study: CAS, F, MEXU, MO, US, WIS.

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Beilschmiedia manantlanensis (Lauraceae), una Nueva Especie de Jalisco, México

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RESUMEN. Se propone a *Beilschmiedia manantlanensis*, una nueva especie de Lauraceae conocida únicamente de la vertiente sur de la Reserva de la Biosfera Sierra de Manantlán, la cual crece en las cañadas que bajan hacia Cuzalapa y Casimiro Castillo. La especie se describe e ilustra, y se compara morfológicamente con otras especies.

ABSTRACT. *Beilschmiedia manantlanensis* is a new species from the rugged western portion of the Sierra de Manantlán Biosphere Reserve in Jalisco, Mexico, an area known to be rich in endemic and disjunct species. The new species is described and illustrated, and its distinguishing characters from similar species are summarized.

A través de la continuación de los proyectos de inventario de la flora vascular de la Sierra de Manantlán y *Flora Arbórea de la Estación Científica Las Joyas, Municipio de Autlán, Jalisco, México*, que se llevan a cabo entre personal de la Universidad de Guadalajara y la Universidad de Wisconsin, se siguen encontrando especies nuevas para la ciencia, como la perteneciente al género *Beilschmiedia*, la cual es propuesta a continuación.

Beilschmiedia manantlanensis Cuevas & Cochrane, sp. nov. TIPO: México. Jalisco: Mpio. Autlán, Cañada del Alentrisco, 1–2 km al S de Corralitos, 19°36′19″N, 104°18′20″W, 1900 m, en bosque mesófilo de montaña, 26 mar. 1998 (fl), *L. Guzmán & F. J. Santana 1616* (holótipo, ZEA; isótipos, BM, CAS, CHAPA, ENCB, F, G, IBUG, IEB, MEXU, MICH, MO, NY, TEX, UCR, US, WIS, XAL). Figuras 1, 2.

Arbor 15–35 m alta, 0.5–1.2 m diametro. Folia alternata vel subverticillata, laminis ellipticis vel oblongis vel oblongo-oblanceolatis, 10–17 cm longis et 3–7 cm latis, apice acutis, obtuse subacuminatis vel rotundatis, basi cuneatis vel obtusis, penninerviis, nervis primariis utroque costae latere 10–16 subpatentibus (sub angulo 50–75° abeuntibus), venulae terminis interdum liberis et reticulum venularum ergo incompletum. Inflorescentia axillaris aspectu terminalis racemoso-paniculata, 2–4 cm longa, ferrugineo-tomentella glabrescentes glauca. Flores parvi bisexuales, perianthio cupulatis, lobis ovato-triangularibus ad suborbiculares 1–2 mm longis, tubo receptaculi 1.5–3 mm longo; androecium verticillastris 4 staminum 3, staminibus fertilibus 9, bilocularibus, seriebus 2 exterioribus eglandulosis, serie 3 conspicue biglandulosis, antheris serierum 2 exteriorum introrsis, serierum interiorum poris 2 lateralibus dehiscentibus, serierum 4 staminodiis 0.6–0.75 mm longis; gynoecio 2–3 mm longo, ovario glabro. Bacca ellipsoidea 3.5–4.5 cm longa et 1.8–2.5 cm diametro.

Arbol perennifolio, de 15–35 m de altura, 0.5–1.2 m de diámetro, corteza escamosa, rojiza; ramillas de 3–4 mm de diámetro, rojizas, glabras a glabrescentes, generalmente pruinosas, exfoliantes con la edad; hojas alternas o más comúnmente agrupadas en los ápices de las ramillas, limbo elíptico a oblongo u oblongo oblanceolado, algunas veces obovado, de 10–17 cm de largo, 3–7 cm de ancho, glabros, cuando jóvenes esparcido puberulentos en ambas caras, ápice agudo, redondeado o oscuramente acuminado, margen entero, base aguda, algunas veces obtusa, nervación prominentemente reticulada, algunas de las venillas de los últimos órdenes terminando libres, y entonces forman una retícula incompleta, con 10–16 pares de nervios primarios que forman ángulos de 50–75° con el nervio medio, el nervio medio y primarios depresos en el haz y salientes en el envés; pecíolos de 5–14 mm de largo, acanalados adaxialmente, glabros a esparcidamente pubescentes, algunas veces exfoliantes; inflorescencias axilares (con apariencia de terminales o subterminales), paniculiformes, de 22–40 mm de largo, ferrugíneo tomentosas, el tomento caedizo, y entonces glaucas; pedúnculo de 5–12 mm de largo; brácteas ovadas a obovadas, de 2.5–4 mm de largo, ápice agudo, acuminado u obtuso, ferrugíneo tomentosas, con los márgenes ciliados; pedicelos de 3–4 mm de largo, glabros; flo-

Figura 1. *Beilschmiedia manantlanensis* Cuevas & Cochrane. —A. Rama y un detalle de la venación de la lámina. —B. Hoja. —C. Flor con bracteola, vista lateral. —D. Fruto. —E. Corte longitudinal del fruto con pericarpio delgado. —F. Semilla. —G. Corte transversal de la semilla. (A, B y D–G de *Cuevas et al. 5083*; C de *Cuevas et al. 4076.)*

res hermafroditas, copuliformes, de 3–4 mm de largo, tépalos 6, imbricados, ovado triangulares a suborbiculares, de 1–2 mm de largo, 1–1.5 mm de ancho, glabros o con tomento disperso en el dorso, internamente pubescentes, ápice obtuso a redondo, margen entero a crenado, tubo receptacular de 1.5–3 mm de largo; androceo de 4 verticilos, de 3 estambres cada uno; el primero y segundo verticilo epitépalos, con anteras de 0.75–1 mm de largo, ditecas, cada teca abriendo por un poro ventral, glabras, filamentos más cortos que las anteras, de 0.25 mm de largo, con pubescencia ferrugínea esparcida, estambres de la tercera serie con anteras y filamentos de 0.5–0.75 mm de largo, las anteras ditecas, cada teca abriendo por un poro lateral, filamentos ferrugíneo tomentosos, cada estambre de la tercera serie con un par de glándulas en su base, éstas de 0.5–0.75 mm de largo, bilobadas a tetralobadas, glabras, la cuarta serie la forman los estaminodios, los cuales son ovado triangulares, laminares, de 0.6–0.75 mm de largo, con el ápice acuminado a agudo, ferrugíneo tomentosos; gineceo de 2–3 mm de largo, glabro, el ovario ovoide cónico; frutos elipsoides, de 3.5–4.5 cm de largo, 1.8–2.5 cm de ancho, glabros; semilla elipsoide, de 2.3–3.3 cm de largo, rojiza.

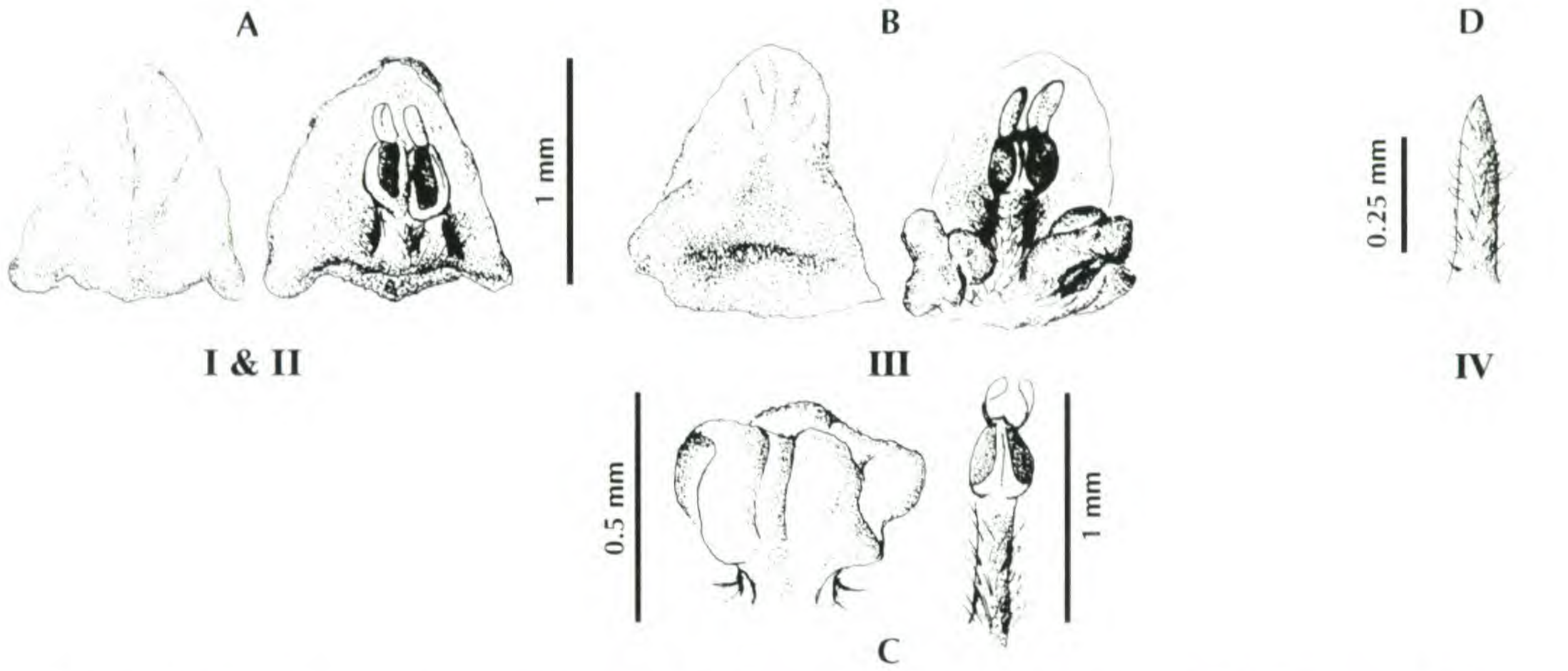

Figura 2. *Beilschmiedia manantlanensis* Cuevas & Cochrane. —A. Detalle de un estambre de la primera y segunda serie, vista abaxial (izquierda), vista adaxial (derecha). —B. Detalle de un estambre de la tercera serie, vista abaxial (izquierda), vista adaxial (derecha). —C. Detalle de la glándula basal (izquierda) y del filamento y antera (derecha) de un estambre de la tercera serie, mostrando los poros laterales. —D. Estaminodio de la cuarta serie. (De *Cuevas et al. 4076.*)

Etimología. Esta especie recibe el nombre por el lugar donde crece, la Sierra de Manantlán, cerca de la costa Pacífica en el estado de Jalisco, México.

Distribución, ecología y fenología. Hasta donde se sabe, es endémica a la vertiente sur de la Sierra de Manantlán, en los municipios de Autlán de Navarro, Cuautitlán y Casimiro Castillo en el estado de Jalisco, México. Es de esperarse, sin embargo, que se encuentre en otras localidades de la Sierra Madre del Sur. Florece de marzo a abril, y fructifica en junio y julio.

Beilschmiedia manantlanensis crece en el bosque mesófilo de montaña, en altitudes de 1000 a 1900 m, en las cañadas que bajan hacia Cuzalapa y Casimiro Castillo; convive con *Fraxinus uhdei* (Wenzig) Lingelsheim, *Clusia salvinii* J. D. Smith, *Juglans olanchana* Standley & L. O. Williams, *Calliandra laevis* Rose, *Gymnanthes riparia* Klotzsch, *Rondeletia amoena* (Planchon) Hemsley, *Cedrela odorata* L., *Guarea glabra* Vahl, *Sideroxylon portoricense* Urban subsp. *minutiflorum* (Pittier) T. D. Pennington, *Prunus cortapico* Kerber ex Koehne, *Sebastiana hintonii* Lundell y *Photinia parviflora* L. O. Williams. Aun cuando el bosque mesófilo de montaña, en el cual vive *B. manantlanensis*, no ocupa una amplia extensión superficial en las partes altas de la Sierra de Manantlán, contiene una gran diversidad florística, así como un buen número de especies endémicas al occidente de México como *Magnolia iltisiana* Vázquez, *Periptera ctenotricha* Fryxell, *Rondeletia manantlanensis* Lorence, *Satureja jaliscana* McVaugh & R. Schmid y *Trophis* sp. nov., y algunas disjuntas como *Acer skutchii* Rehder, *Calatola laevigata* Standley y *Forchhammeria sessilifolia* Standley (Vázquez et al., 1995).

Estado de conservación. La especie aunque no es muy abundante en los sitios que se le ha encontrado, no parece presentar ningún problema de sobrevivencia, pues se han observado individuos de distintas edades estableciéndose el bosque mesófilo de montaña. Por otro lado se ha visto bastante regeneración, la cual parece ser facilitada por la dispersión de los frutos por aves grandes como "chonchо" (*Penelope purpurascens* Wagler).

Usos. Hasta la fecha no contamos con información acerca de los usos de la especie, pero por las características que presentan los fustes es de esperarse que represente un importante recurso maderable.

Relaciones taxonómicas. El género *Beilschmiedia*, al igual que otros de la familia Lauraceae, es poco conocido. Se estima que debe tener entre 10–20 especies en el Neotrópico (van der Werff, 1991). Kostermans (1938), en su revisión de Lauráceas de América, consignó 15 especies, y sólo mencionó a *B. mexicana* (Mez) Kostermans, para México; mientras que Allen (1945) hizo referencia a ocho especies para México y Centro América, señalando únicamente a *B. mexicana* para el país. Finalmente, Lorea Hernández (1995) reconoció ocho especies para México, además de presentar una clave para su identificación. Aun cuando el número de especies de *Beilschmiedia*, registradas para México, ha aumentado desde 1945, la especie aquí publicada representa una clara novedad para la botánica.

Beilschmiedia manantlanensis pertenece al gru-

po de especies que presentan venación prominente, laxa e incompletamente reticulada en ambas superficies. Es diferente al resto de especies neotropicales por tener hojas concentradas hacia al ápice de las ramillas, largos pelos en las inflorescencias y forma y tamaño de las flores. Se diferencia de *B. hondurensis* Kostermans, por presentar las hojas con los ápices agudos a redondeados o obscuramente acuminados, la venación incompletamente reticulada y los frutos más grandes. Un mayor número de pares de nervios primarios en las hojas e inflorescencias más compactas, con mayor número de flores y tomento ferrugíneo o glaucas cuando el tomento cae, son características que permiten diferenciarla de *B. pendula* (Swartz) Hemsley (incluyendo *B. costaricensis* (Mez & Pittier) C. K. Allen y *B. brenesii* C. K. Allen; ver Burger & van der Werff, 1990).

Parátipos. MÉXICO. **Jalisco:** Sierra de Manantlán, Cañada del Alentrisco, 600 m al S de Corralitos, 1800–1900 m, en bosque mesófilo de montaña, 19 jun. 1996, *E. V. Sánchez & R. Cuevas 112* (ZEA); Cañada del Alentrisco, 1–2 km al S de Corralitos, 19°36′19″N, 104°18′20″W, 1900 m, en bosque mesófilo de montaña, 3 mar. 1991, *R. Cuevas, L. Guzmán & E. V. Sánchez 4076* (MO, WIS, ZEA); Cañada del Alentrisco, 1–2 km al S de Corralitos, 19°36′19″N, 104°18′20″W, 1600–1850 m, en bosque mesófilo de montaña, 27 nov. 1996, *R. Cuevas, L. Guzmán & E. V. Sánchez 5083* (IBUG, MO, WIS, ZEA); Cañada de La Vaca, 3 km al SW de El Zarzamoro, en bosque mesófilo de montaña, 6 sep. 1995, *R. Cuevas, E. Sánchez & F. J. Santana 5012* (ZEA); Arroyo de La Cascada, 2.5–3 km al NNE de La Pareja, 1000–1200 m, en bosque mesófilo de montaña, 15 mayo 1997, *R. Cuevas, E. V. Sánchez, L. López, M. Olvera & B. Figueroa 5505* (ZEA).

Agradecimientos. Al Henk van der Werff del Jardín Botánico de Missouri, San Louis, por confirmar nuestras sospechas de que la *Beilschmiedia* de la Sierra de Manantlán era una taxa indescrito y por la revisión del manuscrito; a Aarón Rodríguez por sus comentarios al manuscrito; al James C. McKeown por la revisión del texto en Latín; a Enrique V. Sánchez por la elaboración del dibujo, así como al personal de la Estación Científica Las Joyas y del Laboratorio de Botánica por el apoyo en el trabajo de campo. Trabajo realizado con apoyo de la Comisión Nacional para el Conocimiento y Uso de la Biodiversidad y la Universidad de Guadalajara.

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Studies on Geocalycaceae (Hepaticae). XI. Supraspecific New Taxa and New Combinations in *Chiloscyphus* Corda for Australasia

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ABSTRACT. *Chiloscyphus* sect. *Novae-zeelandii*, sect. *Semiteres*, sect. *Spiniferi*, and sect. *Hemispini* are described as new. *Chiloscyphus* subg. *Connati*, subg. *Microlophocolea*, and subg. *Cyanolophocolea* are new combinations.

The following new taxa and new combinations are the result of a systematic study of the genus *Chiloscyphus* Corda in Australasia. The names are here published separately to make them immediately available for use.

1. **Chiloscyphus** sect. **Novae-zeelandii** Engel, sect. nov. TYPE: *Jungermannia novaezeelandiae* Lehmann & Lindenberg, in Lehmann, Nov. Min. Cogn. Stirp. Pug. 6: 33. 1834.

Plantae dioicae, spicis masculis elongatis, bracteis quam foliis brevioribus, aliter velut in sect. *Heterophylli*.

Plants dioecious; branching of *Frullania*- and lateral-intercalary types or strictly lateral-intercalary; leaves with apex polymorphic, undivided and rounded to retuse to 1-lobed to shallowly bilobed, at times all or a combination of these variants on 1 shoot, the leaf margins entire or armed with 1 or more teeth; underleaves bifid to 0.4–0.85, the lamina margins 1–3 dentate-ciliate; androecia forming elongate spikes, the bracts smaller than leaves; gynoecia on main shoots or long leafy branches, never on short intercalary branches that lack leaves, never on terminal branches.

The section belongs in subgenus *Lophocolea* (Dumortier) Engel & Schuster and is restricted to Australasia.

2. **Chiloscyphus** sect. **Semiteres** Engel, sect. nov. TYPE: *Jungermannia semiteres* Lehmann, Linnaea 4: 363. 1829.

Sectio *Novae-zeelandii* similis, gynoeciis interdum in ramis brevibus aphyllis latero-intercalaribus vel ramis terminalibus vel surculis principalibus, seta cellulis magis numerosis constructis, atque pariete interno capsulae non aequaliter incrassato differt.

Plants with branching terminal-lateral and lateral-intercalary or strictly lateral-intercalary; leaves undivided, the margins entire or dentate; underleaves 2–4-lobed at least to 0.5, at times divided nearly to the base, the lamina margins on each side with a tooth or lobule. Gynoecia often on abbreviated lateral-intercalary branches lacking normal leaves, sometimes on terminal branches or main shoots.

The section belongs in subgenus *Lophocolea*, and is pan-south temperate in distribution.

3. **Chiloscyphus** subg. **Connati** (Lindenberg) Engel, comb. nov. Basionym: *Plagiochila* sect. V. *Connatae* Lindenberg, Species Hepathicarum XXIX. 1839. *Lophocolea* subg. *Connatae* (Lindenberg) Piippo, Ann. Bot. Fenn. 131: 165. 1985. TYPE: (see Piippo, 1985: 165): *Chiloscyphus ciliolatus* (Nees) Gottsche.

4. **Chiloscyphus** sect. **Spiniferi** Engel, sect. nov. TYPE: *Chiloscyphus spiniferus* (Hooker f. & Taylor) Engel & Schuster.

Plantae dioicae. Folia ad apicem subaeque bilobata. Cellulae foliorum amphigastriorum atque perianthiorum laeves sine protuberationibus, eaedem foliorum trigonis minutis. Amphigastria admodum magna, asteroidea, (4)6–lobata, anguste utrinque connata.

Plants dioecious; leaves subequally bilobed; leaf, underleaf, and perianth cells smooth, without protuberances, the leaf cells with small trigones; underleaves exceedingly large, (4–)6-lobed, narrowly connate on both sides.

The section belongs in subgenus *Connati* and is restricted to New Zealand.

5. **Chiloscyphus** subg. **Microlophocolea** (Spruce) Engel, comb. et stat nov. Basionym: *Lophocolea* sect. *Microlophocolea* Spruce, Trans. & Proc. Bot. Soc. Edinburgh 15: 426. 1885. *Lophocolea* sect. *Microlophocolea* (Spruce) Schiffner, in Engler & Prantl, Natürl. Pflanzenfam. 1 (3): 92. 1893. *Chiloscyphus* sect. *Microlophocolea* (Spruce) Engel & Schuster, Nova Hedwigia 39: 410. 1985 (1984). TYPE: *Lophocolea liebmanniana* Gottsche (lectotype, fide Grolle (1976)).

6. Chiloscyphus sect. **Hemispini** Engel, sect. nov. TYPE: *Chiloscyphus parvispinus* Engel.

Plantae dioeciae, rami plerumque latero-intercalares interdum terminalo-laterales nunquam ventro-intercalares, folia pagina dorsali hispida ventrali laevi, lobi amphigastriorum integri vel parce (1–2) dentati.

Plants dioecious; branches mostly of lateral-intercalary type, less often of *Frullania*-type; leaves with dorsal surface hispid, the ventral surface of leaf uniformly smooth; underleaf lobes entire or at most with 1–2 teeth.

The section belongs to subgenus *Microlophocolea* and is restricted to Australasia.

7. Chiloscyphus subg. **Cyanolophocolea** (Schuster) Engel, comb. et stat nov. Basionym: *Lophocolea* sect. *Cyanolophocolea* Schuster, Hep. Anthoc. N. Amer. 4: 238. 1980. *Chiloscyphus* sect. *Cyanolophocolea* (Schuster) Engel & Schuster, Nova Hedwigia 39: 409. 1985 (1984). TYPE: *Lophocolea echinella* Lindenberg & Gottsche.

Subgenera and sections of Australasian *Chiloscyphus* may be distinguished by the following key.

SYNOPTIC KEY TO AUSTRALASIAN SUBGENERA AND SECTIONS OF *CHILOSCYPHUS*

1a. Dorsal (and sometimes ventral) leaf surfaces armed with conspicuous sharp-pointed laminar and marginal processes formed of 1–several cells; perianths armed on external (and often internal) surfaces with spinose cellular processes; antheridial stalk 1-seriate.
  2a. Leaf insertion extended to stem midline dorsally; gynoecia variable in position: acrogynous or cladogynous (the cladogynous lateral- or ventral-intercalary, often or usually bearing vegetative leaves) . . . . . subg. *Microlophocolea*
    3a. Ventral surface of leaf (suboptimal plants aside) with teeth; underleaf segments with opposing teeth or cilia, the abaxial surface of both segments and lamina often with scattered teeth; ventral-intercalary branches at least sometimes present . . . . . sect. *Microlophocolea*
    3b. Ventral surface of leaf uniformly smooth; underleaf segments entire or at most with 1–2 teeth, the teeth never regularly opposing, the abaxial surface of both segments and lamina smooth; ventral-intercalary branches lacking . . . . . sect. *Hemispini*
  2b. Leaf insertion not extending to stem midline dorsally and delimiting a broad leaf free gutter 6–10 cells wide; gynoecia usually on abbreviated ventral-intercalary branches devoid of vegetative leaves . . . . . subg. *Cyanolophocolea*

1b. Leaf surfaces smooth or armed with thick-walled tubercles; perianths smooth, never armed with spinous processes; antheridial stalk 1- or 2-seriate.
  4a. Aspect heteroscyphoid: subopposed leaves consistently and distinctly connate with adjacent, large, conspicuous and broad underleaves, thus each gyre bearing a single, continuous, leaf-complex; innermost capsule wall cells with semiannular bands often furcate and anastomosing to delimit fenestrae; antheridial stalks biseriate . . . . subg. *Connati*
    5a. Leaf, underleaf, and perianth cells armed on both surfaces with prominent, central, dome-like, thick-walled tuberculae one each per cell . . . . . sect. *Leucophylli*
    5b. Leaf and underleaf cells smooth, without protuberances of any sort.
      6a. Underleaves 2–4-lobed or -lobulate, very broadly connate with lateral leaves, without conspicuous basal teeth; leaf cells with nodose trigones . . . . . sect. *Connati*
      6b. Underleaves (4–)6-lobed and with basal accessory teeth, narrowly connate with lateral leaves; leaf cells with small trigones . . . . . sect. *Spiniferi*
  4b. Aspect chiloscyphoid: leaves usually clearly alternate, never conspicuously united with underleaves to form solitary ring-like units, the underleaves free or narrowly connate with leaves on one side (or if consistently narrowly connate on both sides, then connation obscure); innermost capsule wall cells with complete to incomplete to spur-like tangential thickenings that fail to fork or fork only sporadically and do not delimit fenestrae; antheridial stalks 1-seriate.
    7a. Underleaves undivided and entire or at most bifid to 0.3, the lamina margins at most with 1 tooth on each side; ventral-intercalary branching common; leaves oriented subtransverse to subsuccubous, very rarely strongly succubous, the insertion strongly recurved at ventral end, distinctly inverted J-shaped . . . . . subg. *Notholophocolea*
    7b. Underleaves bifid to 0.4 or more, the lamina margins often with 2–3 teeth or a laciniiform to lobuliform process on each side; ventral-intercalary branching rare or lacking; leaf orientation strongly succubous, the insertion not or hardly recurved at ventral end, at most weakly inverted J-shaped . . . . . subg. *Lophocolea*
      8a. Leaves fundamentally undivided, the apices on a single shoot at times variable and then rounded to 1- to 2-lobed, but never consistently bilobed.
        9a. Gynoecial position variable, some to many on short, lateral-intercalary branches lacking normal leaves (others on leading leafy shoots), at times on terminal branches; leaf apices

broadly rounded to retuse or occasionally short bifid, not polymorphic, the shoots without a combination of undivided, 1- and 2-lobed leaves; perianth wings sporadic or lacking; inner layer of capsule wall cells with radial walls devoid of continuous sheets of pigmented thickening; seta 8–11 cells diam., with 26–30 epidermal cell rows; gemmae lacking . . . . . sect. *Semiteres*

9b. Gynoecia on main shoots or long leafy branches, never on short intercalary branches that lack vegetative leaves, never on terminal branches; leaf apices often polymorphic, the shoots with a combination of undivided, 1- and 2-lobed leaves; perianth wings rather common; inner layer of capsule wall cells with continuous sheets of pigmented thickening on vertical radial walls; seta (where known) 6–8 cells diam., with 17–21 epidermal cell rows; gemmae frequent . . . sect. *Novae-zeelandii*

8b. Leaves fundamentally bilobed . . . . . sect. *Lophocolea*

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Austral Hepaticae. 26. The Identity, Taxonomic Position, and Ecology of *Trichocolea julacea* Hatcher (Trichocoleaceae)

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ABSTRACT. A new species, *Leiomitra julacea*, is proposed for the New Zealand *Trichocolea julacea*, which is invalid according to the *International Code of Botanical Nomenclature*. The species is described and illustrated.

The genus *Trichocolea* Dumortier is well represented in tropical montane areas and to a lesser extent the south temperate zone. Only a single species, *T. tomentella* (Ehrhart) Dumortier, occurs in temperate areas in the Northern Hemisphere, where it is disjunctly widespread in range. *Trichocolea tomentella* is the type of the genus.

Gottsche (1864: 132) subdivided *Trichocolea* into two sections, sect. *Hirtiflora* Gottsche (= sect. *Trichocolea*) and sect. *Laeviflora* Gottsche. He characterized section *Hirtiflora* as having a hairy "involucrum," i.e., the calyptra, which is fused with and surrounded by bracts and bracteoles. Three species were assigned to this section: *T. tomentella*, *T. mollissima* (Hooker f. & Taylor) Gottsche, and *T. lanata* (Hooker) Nees. The other section, *Laeviflora*, was defined as having a smooth calyptra, devoid of bracts, and contained one species, *T. tomentosa* (Swartz) Gottsche, which is therefore the type of the section. Lindberg (1875) created a new genus, *Leiomitra* Lindberg, which included *T. tomentosa* and a new species, *L. capillata* Lindberg. He distinguished the genus from *Trichocolea* in part by the lack of regularly pinnate branching, and on the characters cited by Gottsche for *Trichocolea* sect. *Laeviflora*. However, Gottsche's section was not cited as a synonym.

Leiomitra has been variously treated by subsequent authors. Spruce (1884–1885) recognized *Leiomitra* as a genus and included four neotropical species: *L. tomentosa* (Swartz) Lindberg, *L. flaccida* Spruce, *L. sphagnoides* Spruce, and *L. paraphyllina* Spruce. Stephani (1888) and Bescherelle (1893) also accepted the genus. Schiffner (1893–1895) treated *Trichocolea* as a genus and recognized Gottsche's sections as subgenera; *Leiomitra* Lindberg was cited as a synonym of subgenus *Laeviflora* (Gottsche) Schiffner. Schiffner's description of subgenus *Hirtiflora* (Gottsche) Schiffner emphasized succubously oriented leaves, repeatedly pinnate branching, and the presence of a fleshy, wooly "calyptra" having both bracts and sterile archegonia inserted on it; the subgenus included six species. By contrast, subgenus *Laeviflora* had incubously oriented leaves, less regularly pinnate branching, and a "calyptra" that was both thin and smooth throughout, or at least in the upper portion. Schiffner included seven primarily neotropical species in subgenus *Laeviflora*, including *T. tomentosa*. Spruce (1895) was the first to treat *Leiomitra* as a subgenus, subg. *Leiomitra* (Lindberg) Spruce. Subgenus *Laeviflora* (Gottsche) Schiffner has less than a three-week priority over subgenus *Leiomitra* (Lindberg) Spruce (15 January vs. 5 February fide Stafleu & Cowan, 1985).

Leiomitra was included as a synonym of *Trichocolea*, without subgeneric status by, e.g., Stephani (1898–1924), who regarded the two genera as the same on developmental grounds; Verdoorn (1932); Evans (1939); Müller (1951–1958); Hatcher (1957); Fulford (1963); Gradstein (1989); Fulford and Sharp (1990); Gradstein and Florschütz-de Waard (1990); and Schuster (1966). Little (1949: 10) lectotypified *Leiomitra* Lindberg with *L. tomentosa* (while including the genus in the synonymy of *Trichocolea*). *Leiomitra* was recognized as a distinct genus by Schuster (1980, 1984) and by Grolle (1983). Schuster and Grolle placed both *Trichocolea* and *Leiomitra* in the Trichocoleaceae.

Schuster (1963) added a third genus to the Trichocoleaceae, *Eotrichocolea* Schuster, based on *Trichocolea polyacantha* (Hooker f. & Taylor) Gottsche et al. of New Zealand. Schuster (1980) discussed interconnections of the Trichocoleaceae with a group of genera that includes *Temnoma* in the Pseudolepicoleaceae Fulford & J. Taylor, and merged the two families into one family, Trichocoleaceae, with four subfamilies: Trichocoleoideae, Temnomoideae Schuster, Blepharostomatoideae Grolle, and Chaetocoleoideae Schuster (Schuster, 1980, 1984).

Hatcher (1958) described *Trichocolea julacea* Hatcher, based on a plant from Stewart Island, New Zealand. Known only from the protologue, this spe-

cies has remained somewhat of a mystery plant. Examination of the type, and material recently collected in New Zealand, reveals that the plant possesses characters that place it in *Leiomitra*, and a new combination is therefore required, as follows:

Leiomitra julacea Hatcher ex Engel, sp. nov. *Trichocolea julacea* Hatcher, Trans. Roy. Soc. New Zealand 85: 245. f. 30–36. 1958, nom. inval. (Art. 37). TYPE: New Zealand. Stewart Is.: Port Pegasus, Sawmiller's Arm, 1949, *Martin 621* (holotype, F; isotype, UWM). Figure 1.

Plants spongy, distinctly julaceous, with all sides appearing as a mass of interwoven cilia, loosely creeping, chocolate brown (the shoot tips light green), the shoots to 2 mm wide. Branching irregularly sympodial to pseudodichotomous, the leading axis soon losing its dominance, the main shoot and branches alike in vigor. Stem lacking paraphyllia, hidden on all sides by interwoven leaf cilia. Rhizoids occasional, in tight bundles, from stem at immediate base of underleaves, the tips often branched. Leaves widely spreading but with lobes arching toward shoot apex, rather closely imbricate, distinctly succubously (almost longitudinally) inserted, the lamina twisted: ventral sector of leaf oriented parallel with substrate, the dorsal sector of leaf antically assurgent and the dorsal margin seen on edge, the leaves obtrapezoidal to subreniform, asymmetrically 4–6-lobed, the ventral pair of lobes largest, the dorsal lobe smallest. Lobes caudate, not 3-fid, the ventral pair of lobes 4–5 cells wide at base (tier immediately above sinus base), then 2–3 tiers of laterally juxtaposed cells basal to the uniseriate row of 6–10 cells; cells of uniseriate row ± cylindrical, with dilated septa, 13–25 μm wide, 62–98 μm long, the cells toward base of uniseriate row rather thick-walled, the cells becoming progressively smaller and less thick-walled toward lobe apices, the cuticle of penultimate and terminal cells striolate-papillose, that of the remaining cells finely striolate; terminal cell of uniseriate row somewhat tapered, 10–12 μm wide, 68–90 μm long, slightly thick-walled in the tip; margins of lobes copiously armed with pairs of opposing cilia, the cilia of lobes and sinus bases repeatedly dichotomously branched, the branches of each dichotomy stiffly diverging, but the armature primarily directed adaxially and oriented at right angles to the leaf plane, the leaf thus appearing to have a stiffly ciliate adaxial leaf surface, the cilia ultimately forming a densely interwoven dendroid crown to the leaf; marginal cilia of lobe uniformly uniseriate throughout, the cells elongate, rather thick-walled, the cuticle of cells toward base of cilium striolate, the cuticle of cells toward and including terminal cell striolate-papillose; sinus bases plane and not reflexed. Disc slightly convex, asymmetric, 3–4 cells high at dorsal sinus, 5–6 cells high at ventral sinus (from base to sinuses); margins of disc with dichotomously branched cilia similar to those of lobes, the cilia often adaxially displaced and lying at right angles to the disc plane. Underleaves somewhat smaller than leaves, narrowly connate on both sides, cuneate, quadrifid, the marginal armature similar to leaves and likewise forming a mass of interwoven cilia; disc 3–4 cells high. Cells of disc thin-walled, strongly elongated, aligned in somewhat irregular tiers, in lamina middle 22–26 μm wide × 84–108 μm long; cuticle markedly long striolate, with only a few papillae. Asexual reproduction lacking. Otherwise unknown.

Nomenclature. The name *Trichocolea julacea* is invalid according to the ICBN, Art. 37 (Greuter et al., 1994), which requires that after 1 January 1958 a holotype for new species must be indicated. Hatcher (1958) made no reference to a nomenclatural type for the species (see also Art. 7), but stated that "portions of the original collection," gathered by Martin, are in four herbaria, including that of Martin followed by the number 621 in parentheses. The specimen retained by Hatcher (now at F) bears the locality that matches the protologue, but also includes the number 621 and "TYPE" on the label. That specimen is herein designated the holotype. The above description and accompanying illustration (Fig. 1) are based on this collection.

Distribution and ecology. Known only from the type collection and the Cascade ultramafic moraine in southern Westland Province. There the species occurs at ca. 135 m in an area of ultramafic rocks and outcrops with rather open vegetation consisting mainly of *Gleichenia*, *Lycopodium*, *Juncus*, the lichen *Cladina*, and scattered *Leptospermum*. The species forms thick, nearly pure mats on well-drained soil of slopes and vertical banks of drainage channels. Hatcher (1958) mentioned that the type was "epiphytic; on forest trees."

Additional specimens examined. NEW ZEALAND. **South Island:** Westland Prov., Cascade Road, Cascade ultramafic moraine, W of Martyr Saddle, SSW of Jackson Bay, ca. 135 m, *Engel 21779, 23001* (F).

Taxonomy. Only juvenile gynoecia are known for the species (the type), but the irregularly sympodial to pseudodichotomous branching pattern (with the leading axis soon losing its dominance) and the distinctly succubously to nearly longitudi-

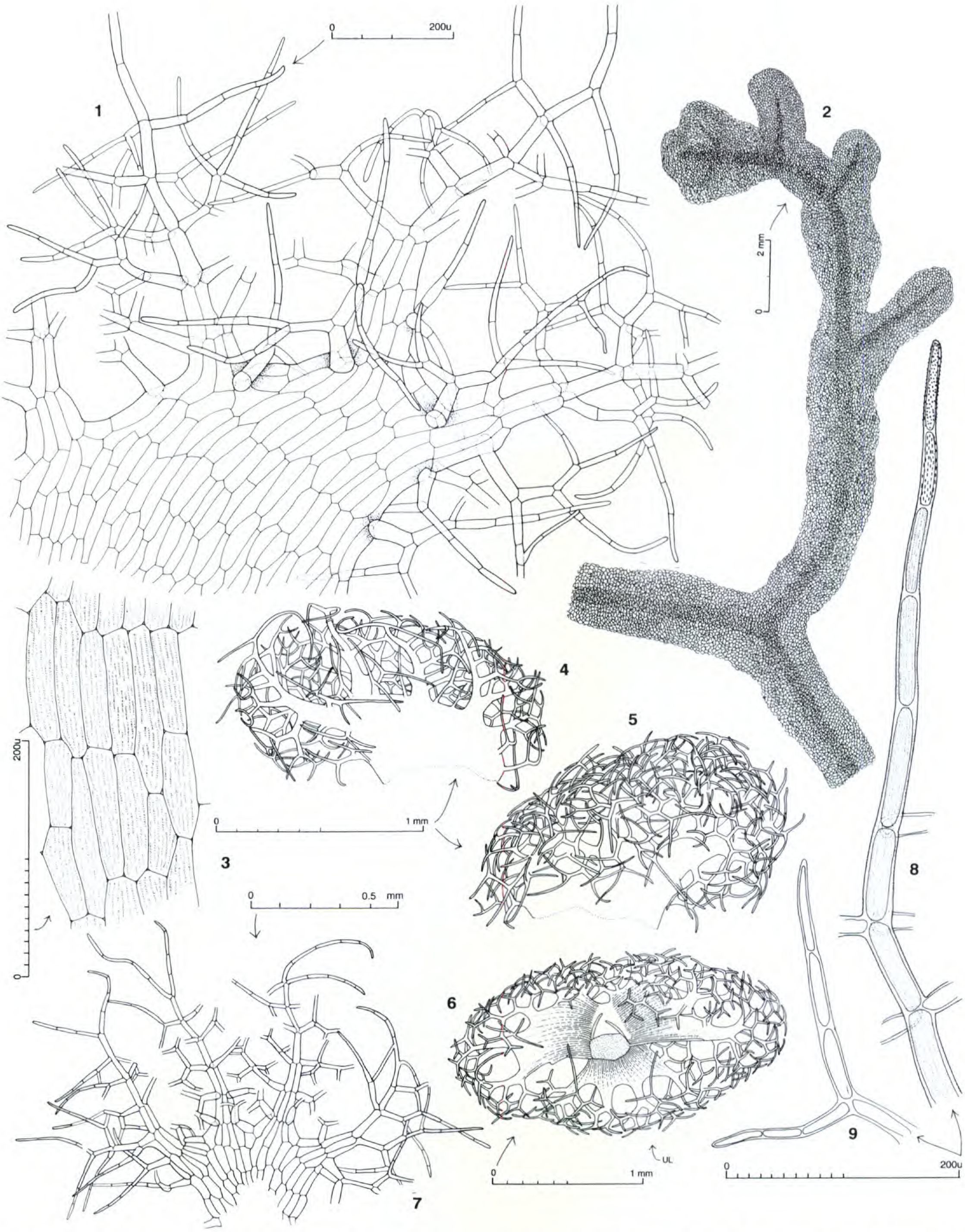

Figure 1. *Leiomitra julacea* Hatcher ex Engel. —1. Ventral sector of leaf, adaxial aspect (some portions of marginal armature not shown for clarity). —2. Shoot, dorsal view. —3. Median cells of lamina. —4. Leaf, adaxial view. —5. Leaf, abaxial view. —6. Cross section of shoot showing mass of interwoven, branched cilia (UL = underleaf) of 1 gyre. —7. Underleaf (some portions of marginal armature not shown for clarity). —8. Leaf lobe, distal sector. —9. Lateral armature of leaf lobe, distal sector. (All from holotype.)

nally inserted leaves are characters that place this species in *Leiomitra*. *Trichocolea* s. str. has regularly 2–3(4)-pinnate branching, with the main axis retaining its dominance and the leaf insertion varying from weakly succubous to weakly incubous.

The leaves of this species are remarkable for their development of a densely interwoven "basketwork" of cilia (Fig. 1: 4–6), which causes the axis and branches to appear spongy and julaceous (Fig. 1: 2); the cilia are repeatedly dichotomously branched and widely divergent (Fig. 1: 1), the ultimate divisions of each leaf forming a densely interwoven dendroid "crown." Living plants, as well as the type, are brownish. Branching is irregularly sympodial to pseudodichotomous, as in *Leiomitra lanata* (Hooker) Schuster, but the form of the leaves will immediately distinguish this species. The species is readily distinguished in the field by the julaceous, wiry aspect of the plants coupled with the brownish color.

Leiomitra julacea and *L. lanata*, also of New Zealand, are the only south temperate members of the genus; all other species of *Trichocolea* reported from the south temperate belong to that genus (s. str). The two New Zealand species of *Leiomitra* may be distinguished by the following key.

KEY TO NEW ZEALAND SPECIES OF *LEIOMITRA*

1a. Leaf lobes equally 3-fid, consisting of an adaxially divergent segment and a pair of abaxially divergent segments, each segment usually 1(2) times again 3-fid, ending in a pair of ± equally divergent, uniseriate cilia; leaf disc 6–10 cells high; plants grass green to yellowish green; common, North and South Islands . . . . . *L. lanata*

1b. Leaf lobes caudate, not 3-fid, the margins armed with pairs of opposing cilia, the cilia repeatedly dichotomously branched and forming a densely interwoven dendroid crown; leaf disc 5–6 cells high; plants brown; rare, Stewart Is. and southern Westland Prov. . . . . *L. julacea*

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Austral Hepaticae. 28. *Plagiochila bazzanioides* Engel & Merrill, a Remarkable New Species of Plagiochilaceae from New Zealand

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ABSTRACT. *Plagiochila bazzanioides*, a new species from New Zealand, is described and illustrated.

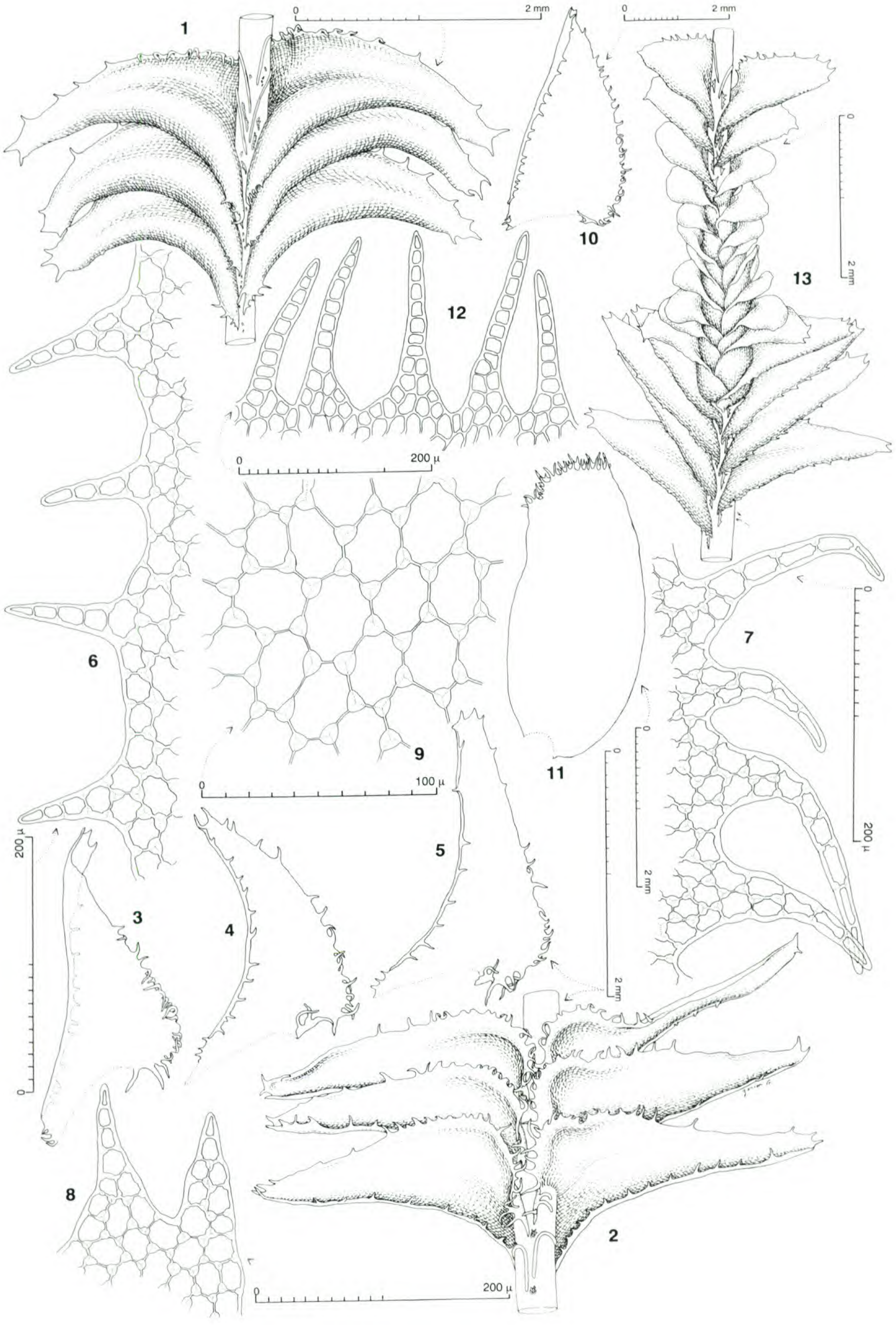
Plagiochila is the largest genus of hepatics, with perhaps as many as 1600 described species (Bonner, 1962). As in other species-rich groups, the actual number of species will probably prove to be considerably less. According to Schuster (1980: 348), "The total number of valid species of *Plagiochila* may prove to be below 500." The genus is widely distributed and essentially cosmopolitan. Centers of taxic diversity are chiefly in the Neotropics and southeast Asia, and the genus is rather poorly represented in temperate areas. For example, Schuster (1980) included 20 species for North America, and Inoue and Schuster (1971) included 25 species from temperate Australasia. This paper describes an additional distinctive species occurring in New Zealand, as follows.

Plagiochila bazzanioides Engel & Merrill, sp. nov. TYPE: New Zealand. North Island: North Auckland Province, Rangitoto Island, immediately E of Auckland, 50–160 m, 4 Feb. 1995, *Engel 20769* (holotype, F; isotype, CHR). Figure 1.

Species insignis foliis falcatis canaliculatis decurvatis, marginis foliorum pectinatis dentibus gracilibus uncinatis, ramis plurimis flagelliformibus, androeciis intercalaribus, paraphylliis caulis dentatis lamelliformibus a species nobis notis optime distincta.

Plants bazzanioid in habit, ascending, without differentiation of a horizontal leafless axis, rich, deep olive green; leafy shoots medium, to 5 mm wide. Stems with paraphyllia inconspicuous, typically consisting of a single, short, sharply toothed lamella adjacent to dorsal leaf base; stem in cross section with cortical cells in (2)3 layers of very thick-walled cells, the medullary cell walls thin, colorless. Branching exclusively lateral-intercalary, sometimes with geotropic, microphyllous, rhizoidous, flagelliform, lateral-intercalary branches. Rhizoids rather dense on leafy shoots. Leaves horizontally spreading to ventrally secund, often conspicuously falcate, spreading at ± right angles to stem, closely imbricate, frequently canaliculate-subtubular to the tips, the dorsal margins narrowly recurved and forming a distinct convex fold, lending the shoot a tightly pleated aspect in dorsal view, in ventral aspect the ventral margin aligned at right angles to the stem except for the basal sector, which lies parallel to the stem, in ventral view the ventral margins pectinate-toothed, the teeth often stiffly reflexed and hooked dorsally, the ventral surface of stem moderately or totally hidden; leaf insertion elongated, distinctly straight and steeply oblique for most of its length, abruptly recurved at ventral end; leaves asymmetrically narrowly elongate-trapezoidal, tapering to a markedly narrow, almost parallel-sided distal 0.2 to 0.3; leaf apex narrowly rounded to truncate, tending to become bidentate by 2 conspicuous, often diverging apical teeth that are often larger than adjacent teeth; dorsal margin nearly straight to broadly curved inward, with ± regularly spaced, slender, recurved teeth to the base (best seen in ventral aspect); ventral margin ± straight from a subauriculate base, conspicuously ciliate-dentate particularly in basal portion, the teeth stiffly reflexed (hooked dorsally), the margin often entire or subentire in the distal 0.5, decurrent, the decurrent strip dentate. Marginal teeth slenderly acuminate, 1–2 cells wide at the base, consisting almost entirely of a uniseriate row of 4–6 distinctly thick-walled cells, the terminal cell elongate, to 4.2:1. Underleaves consisting of an amorphous clump of cells, in part short-filamentous, at end of decurrent ventral leaf base. Cells in median portion of leaf thin-walled and with trigones bulging to knotlike; median cells 20–29 μm wide × 30–36 μm long; cells of leaf bases scarcely elongated and not forming a basal field; cuticle smooth. Asexual reproduction lacking.

♂ Plants ± smaller than the ♀ ones, mostly simple; androecia on main shoot and leading lateral-intercalary branches, becoming intercalary in position (often with several successive androecia occurring on a stem or branch); bracts many, in up to 15 pairs, strongly saccate in dorsal half of base; apex broadly rounded, spatulate, entire; ventral mar-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gin reflexed, entire or with a few spinose teeth near base; lobule large, the free margin very short, inflexed, slightly to moderately dilated, with a few minute teeth; antheridia 1 per bract, the stalk 2-seriate. Gynoecia at apices of main or leading shoots, usually with 1–2 innovations in absence of fertilization, the gynoecia with irregular, ciliiform-margined paraphyllia in dorsal sector of axil of innermost bracts; bracts of innermost series similar to leaves except somewhat larger and broader, narrowly ovate, with margins armed as in leaves. Perianth slightly inflated in basal sector but strongly bilaterally compressed above, the dorsal and ventral keels wingless; mouth truncate, with crowded, irregular, spinose teeth and cilia, the teeth 2–3 cells wide at the base and with a uniseriate row of up to 8 cells.

Sporophyte not seen.

Taxonomy. The dorsal surface of the stem in *Plagiochila bazzanioides* bears sharply toothed, lamelliform paraphyllia (Fig. 1: 1) as in *P. circumdentata* Stephani, and is assigned to *Plagiochila* sect. *Annotinae* Carl, together with that species, *P. annotina* Menzies ex Lindenberg, and *P. baylisii* Inoue & Schuster, all of New Zealand (see Inoue & Schuster, 1971). The latter two species, however, lack stem paraphyllia. *Plagiochila circumdentata* has broadly ovate to deltoid-ovate leaves with a rounded, non-canaliculate apex and a strongly ampliate ventral margin. This species also differs in the position of androecia, often occurring on clusters of terminal, *Frullania*-type branches, whereas in *P. bazzanioides* the androecia are confined to the main shoot and leading lateral-intercalary branches, often becoming intercalary in position (Fig. 1: 13), with several successive androecia produced on a single shoot or branch.

The marginal teeth of the leaves of *Plagiochila bazzanioides* are unique among New Zealand species of the genus in being slender, stiffly hooked, and claw-like (Fig. 1: 1–5), consisting almost entirely of a uniseriate row of up to 6 cells in length (Fig. 1: 7). The distinctly pectinate dorsal leaf margins resemble the teeth of a garden rake, and are apparent even under the dissecting microscope.

Plagiochila bazzanioides is notable for the remarkable *Bazzania*-like aspect of the plants, a combination of the ventrally decurved, falcate, narrowly channeled leaves with a truncate, few-toothed apex, and the frequent production of geotropic, flagelliform branches up to 2.5 cm long. Otherwise, in leaf shape and orientation *P. bazzanioides* resembles a slender *P. obscura* Colenso: both species have more or less attenuate, narrowly trapezoidal leaves. As in *P. obscura*, the leaf insertion is straight and steeply oblique for most of its length (Fig. 1: 1), and the ventral margin is straight and not ampliate, except for the short, truncate portion near the base, which in situ lies parallel with the stem (Fig. 1: 2). Also, as in *P. obscura*, the distal portion of the ventral margin is often entire, with the basal portion conspicuously armed with regularly spaced, slender, hooked teeth (Fig. 1: 2).

Distribution and ecology. Known only from Rangitoto Island (just east of Auckland) in forest primarily of *Metrosideros* that has developed over a lava flow. The species occurs at 50–160 m on thick soil over shaded rock, as well as festooning the sides of very protected, moist niches.

Paratype. NEW ZEALAND. **North Island:** same locality as type, *Engel 20756*–c. ♂ (F).

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Figure 1. *Plagiochila bazzanioides* Engel & Merrill. —1. Sector of main shoot, dorsal view (note stem paraphyllia). —2. Sector of main shoot, ventral view (note rudimentary underleaves). —3–5. Leaves drawn to same scale (3 = dorsal aspect; 4, 5, ventral aspect). —6. Teeth of dorsal margin of leaf. —7. Teeth of ventral margin of leaf. —8. Leaf apex. —9. Median leaf cells. —10. Innermost ♀ bract (ventral aspect). —11. Perianth. —12. Portion of perianth mouth. —13. Sector of shoot with androecium. (Figs. 1–12, from holotype; Fig. 13, from *Engel 20756*, New Zealand, North Auckland Prov., Rangitoto Is., immediately east of Auckland.)

Taxonomic Notes on Neotropical *Maprounea* Aublet (Euphorbiaceae)

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ABSTRACT. A key to and some remarks on *Maprounea* in the Neotropics are presented. *Maprounea guianensis* var. *obtusata* is discussed and raised to specific rank with the new name *Maprounea amazonica*. *Maprounea brasiliensis* is accepted as distinct from *M. guianensis*. The taxa are separated mainly by characters of the leaves and by fruit size. Additionally, *Maprounia glauca* is established as a new synonym of *Mabea taquari*, and a lectotype is designated for the latter.

Maprounea Aublet (Euphorbiaceae, Hippomaneae) is a small genus of shrubs and trees occurring in the Neotropics and in Africa. Although the South American taxa have been treated twice quite recently, their taxonomy is still not fully resolved.

Pax and Hoffmann (1912) accepted two neotropical species, *Maprounea guianensis* Aublet and *M. brasiliensis* A. Saint-Hilaire, both without infraspecific taxa. Allem (1976), however, considered these two species to be identical and united them under the older name, *M. guianensis*. Senna (1984) disagreed with him and accepted both species as well as a number of varieties of *M. guianensis*, with the exception of *M. guianensis* var. *undulata* Müller Argoviensis, which she did not consider to be distinct from the typical variety.

Allem's (1976) study was based mainly on plants from central Brazil and concentrated on floral characters, neglecting the varieties described from other regions. The revision of Senna (1984) was uncritical, although it included very detailed illustrations of all taxa. From these illustrations it is quite obvious that the leaves of *M. guianensis* var. *obtusata* (Müller Argoviensis) Müller Argoviensis are very different from those of all other neotropical taxa of the genus.

On further examination of leaf and fruit characters in particular I now conclude that this variety represents a distinct species, and also that *M. brasiliensis* should be kept separate from *M. guianensis*.

KEY TO THE NEOTROPICAL SPECIES OF *MAPROUNEA*

1a. Leaves apically obtuse to rounded to emarginate, abaxially eglandular at base (Fig. 1A); 0–1 pistillate flower per inflorescence; staminate inflorescence at least as wide as long; fruits 8–10 mm long . . . . . *M. amazonica*

1b. Leaves apically acute to mucronate to acuminate, rarely obtuse, abaxially often with basal glands, rarely without; (0–)2–3 pistillate flowers per inflorescence; staminate inflorescence longer than wide; fruits 4–10 mm long.

2a. Tree up to 25 m tall; leaves distinctly longer than wide, apically acute to acuminate, abaxially with 0–1(–2) pair(s) of base glands (Fig. 1F), often with additional submarginal glands in upper half; fruits 4–6(–8) mm long . . . . . *M. guianensis*

2b. Shrub up to 1.5 m tall; leaves hardly longer than wide, apically mucronate, rarely obtuse, abaxially usually with 2–4 pairs of basal glands (Fig. 1G), eglandular in upper half; fruits 8–10 mm long . . . . . *M. brasiliensis*

Maprounea amazonica Esser, nom. et stat. nov. Replaced name: *Maprounea guianensis* Aublet var. *guianensis* forma *obtusata* Müller Argoviensis, Linnaea 32: 115. 1863. *Maprounea guianensis* Aublet var. *obtusata* (Müller Argoviensis) Müller Argoviensis, in Martius, Fl. Bras. 11.2: 543. 1874. TYPE: Brazil. Amazonas: Barra (= Manaus), igapó of an igarapé, May 1851, *Spruce 1475* (lectotype, selected here, G-DC not seen, microfiche; isolectotypes, BM, BR, E, GH, K, NY, OXF, P, TCD). Figure 1A–E.

The name *Maprounea obtusa* Pax already exists for an African species. A new combination based on the neotropical variety *obtusata* would be very similar to the African name, and because of the risk of confusion a new name, *M. amazonica*, was chosen according to Article 53.3 of the *International Code of Botanical Nomenclature* (Greuter et al., 1994).

Shrub or tree up to 12 m tall and 15 cm stem diam. Bark smooth. Totally glabrous. Monoecious. Stipules broadly elliptic, ca. 0.7–0.9 × 0.5–0.9

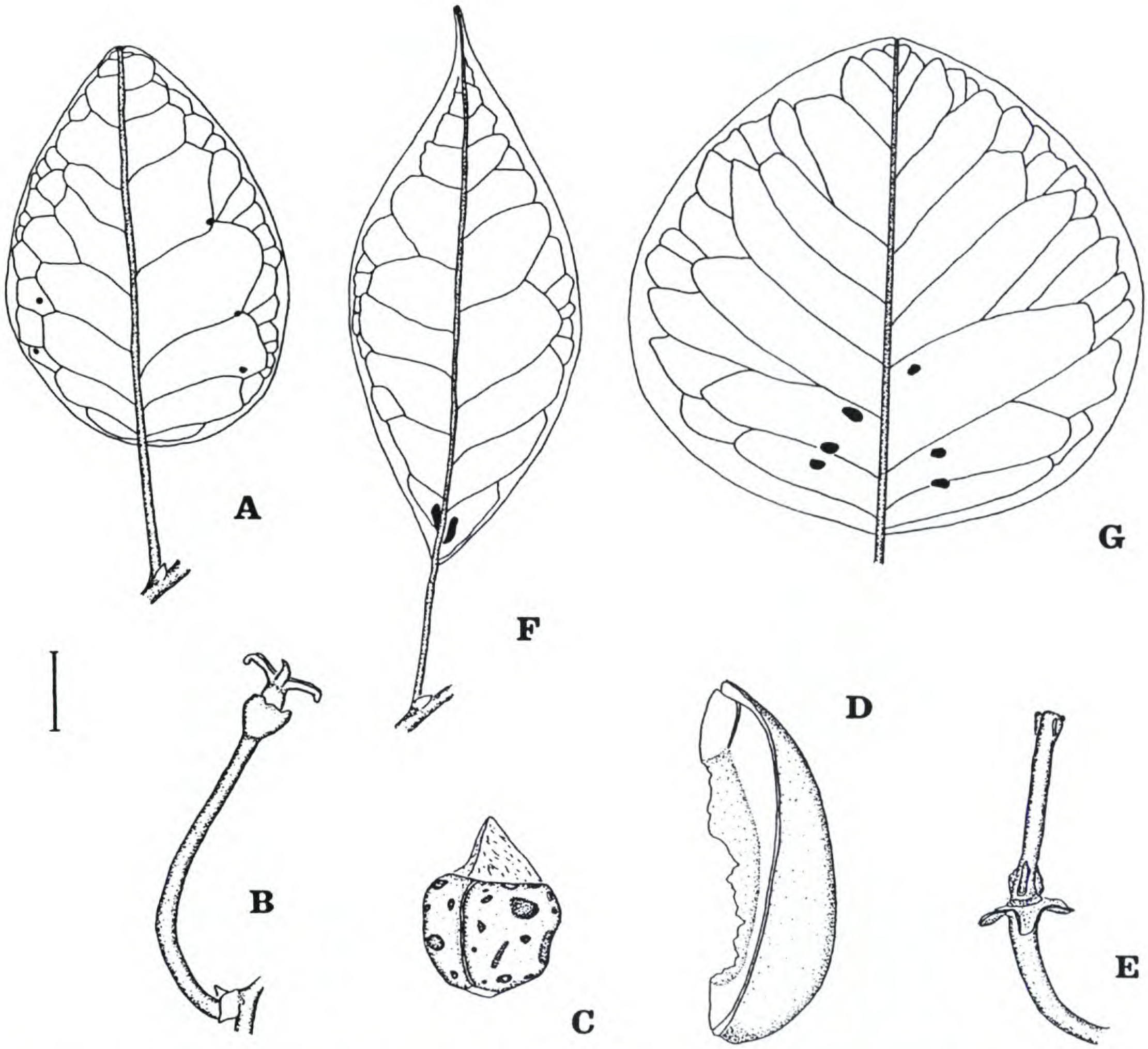

Figure 1. A–E. *Maprounea amazonica* Esser. —A. Leaf, showing glands on lower surface. —B. Pistillate flower. —C. Seed with large caruncle and foveolate surface. —D. Mericarp of fruit with irregularly caducous septum and single apical vascular strand. —E. Remaining columella of fruit without septal remnants. —F. *Maprounea guianensis* Aublet. Leaf, showing glands on lower surface. —G. *Maprounea brasiliensis* A. Saint-Hilaire. Leaf, showing glands on lower surface. Scale bar = 5 mm (A, E–G) or 2 mm (B–D). A, B drawn from *Prance et al. 11752* (U); C–E from *Prance et al. 16174* (U); F from *Spruce 2271* (TCD); G from *Hatschbach 36979* (HBG).

mm, entire, eglandular; petioles 0.9–1.8 cm long; leaf blades membranous to chartaceous, ovate to orbicular, 2.5–5 × 1.5–3.5 cm, apex obtuse to rounded to emarginate, margin entire, base slightly emarginate to rounded to slightly obtuse, distinctly whitish below and with (0–)1–6 glands on each side of midvein, glands 0.2–0.4 mm diam., submarginal, often associated with secondary veins, strictly eglandular at base, secondary veins in 8–13 pairs and irregularly brochidodromous. Inflorescences greenish to yellowish (staminate flowers sometimes reddish), usually on short lateral branches, consisting of a peduncle 5–8 mm long and a head of staminate flowers 2–2.5 mm long and 2–3 mm diam. and 0–1 pistillate flower inserted near base of peduncle. Staminate flowers nearly sessile; calyx ca. 0.75 mm long; stamens 2, filaments up to 1 mm long, partly fused, anthers ca. 0.2 mm long. Pistillate flowers: pedicel 2–9 mm long; calyx with 3 free sepals, when flowering nearly as long as ovary; style nearly absent, stigma ca. 1.5 mm long. Fruits greenish, pedicel 7–17 mm long; schizocarp globular and slightly sulcate, smooth, dry, opening first loculicidally and soon afterward septicidally; mericarps 8–10 mm long, pericarp ca. 1.2 mm thick, septa very thin, fragile, early and irregularly caducous, remaining columella terete, not winged (Fig. 1E). Seeds 4–4.5 × 4 mm, with a large caruncle and distinctly foveolate surface (Fig. 1C).

The invariable absence of a distinct leaf apex

and of basal glands (Fig. 1A) are unique in neotropical *Maprounea*. Additionally, the style is very short, almost absent (Fig. 1B), whereas it is usually distinct and 0.5–2 mm long in the other species. The staminate flowers are similar in all taxa, just as they are in closely related species throughout the Hippomaneae. *Maprounea amazonica* grows along rivers, particularly in igapó forests and periodically inundated white sand campinas, whereas both other species occur in non-inundated savannas, and secondary and evergreen forests.

In the Neotropics, *Maprounea* is represented by one widespread species, *M. guianensis*, which occurs from Panama to Bolivia, and two species with a more restricted distribution, *M. amazonica* and *M. brasiliensis*.

Maprounea amazonica appears to be confined to northern and central Amazonia and is most common in the Rio Negro basin. A single record of *M. amazonica* for eastern Amazonia (Pará), cited by Senna (1984), unfortunately could not be examined for this study. In the Guianas of northeastern South America (French Guiana, Guyana, Suriname) *M. guianensis* is the only species that occurs there. One hundred thirty-two collections I studied for a recent revision of the genus for the *Flora of the Guianas* (Esser, in prep.) belong to this species.

Maprounea brasiliensis seems to be restricted to the cerrado of central Brazil, in Goiás, Minas Gerais and the Distrito Federal. Senna (1984) also cited collections from Bahia, but these were not available for examination. The distinction between *M. brasiliensis* and *M. guianensis* is less clear-cut than those between either of them and *M. amazonica*. Among the specimens of *M. guianensis* studied, only one (*Williams 6470* from Peru) showed an exceptional fruit length of 6–8 mm; in all other cases the fruit size was sufficient for distinction from *M. brasiliensis*.

The African *M. africana* Müller Argoviensis, of which the abovementioned *M. obtusa* Pax is a synonym, has leaves very similar to those of *M. amazonica*. It differs sufficiently by inflorescences with (1–)2–3 pistillate flowers, long styles, staminate inflorescences distinctly longer than wide, and 6–8-mm-long seeds with a completely smooth surface.

Additional specimens examined. BRAZIL. **Amazonas:** Rio Negro between Paraná da Floresta and Rio Branco, 26 June 1979 (fl), *Alencar 42* (GH); Rio Negro, Taruma, 26 Apr. 1911 (fl), *Ducke MG 11574* (BM); Manaus, Igarapé da Cachoeira Grande, 28 Mar. 1937 (fl), *Ducke 435* (A); Rio Taruma-mirim, Comunidade Nossa Senhora de Fátima, 16 May 1992 (fl), *Ferreira 230* (K), 16 May 1992 (fr), *Ferreira 244* (K); Rio Negro, Rio Marié, 12 June 1947 (fl), *Fróes 22394* (U); Rio Negro between Ilha do Japó and Barcelos, 27 June 1979 (fr), *Poole 1687* (K); Rio Negro opposite Manaus 3–6 km upstream, 8 Apr. 1971 (female fl), *Prance, Coêlho et al. 11752* (K, U); Rio Negro, Rio Cuieras just below mouth of Rio Brancinho, 26 Sep. 1971 (fl), *Prance, Coêlho & Monteiro 14878* (U); Rio Uneiuxi, 5 km above mouth, 8 Nov. 1971 (fr), *Prance, Maas et al. 16174* (K, U); Rio Negro 30 km above Manaus, 28 Sep. 1974 (fl), *Prance 22763* (U); Rio Aracá near Serrinha, 80 m, 25 July 1985 (fr), *Prance, Mota & Silva 29769* (K); without locality, without date (fl), *Regnell III-639* (BM, P); Cachoeira Grande bei Manaus, May 1910 (fl), *Ule 8898* (K, L). COLOMBIA. **Vichada:** Parque Nacional Natural "El Tuparro," S edge of Laguna Guaipé, 80 m, 27 Feb. 1985 (fr), *Zarucchi & Barbosa 3490* (K). VENEZUELA. **Amazonas:** Bana, 4.5 km SSW from mouth of Río Temi, 100 m, 6 Mar. 1996 (fr), *Berry, Romero & Brako 6035* (TCD); bank of Orinoco River near Samariapo, 90 m, 17 Nov. 1965 (fr), *Breteler 4714* (K); Caño Caname, 100 m, 3 May 1979 (fl), *Davidse, Huber & Tillett 17151* (K); Caño Perro de Agua, 100 m, Nov.–Dec. 1978 (fr), *Huber & Tillett 2751* (K); Caño Butrón, afluente del Caño Ucata, 70 m, 21 Oct. 1989 (fr), *Romero & Melgueiro 2151* (GH); Samariapo, 124 m, 2 July 1942 (fl), *Williams 15957* (A); Caño San Miguel just above Limoncito, 15 km from Río Guainía, 120 m, 28 June 1959 (fl), *Wurdack & Adderley 43218* (GH, K).

Hamilton (1825) described *Maprounia glauca*. This name has never been used subsequently, and its interpretation has remained uncertain. It was usually placed in *Maprounea*, and *Maprounia* was treated as an orthographic variant of it (see Farr et al., 1979; Howard et al., 1981). However, Senna (1984) excluded the species from *Maprounea*, stating that it may belong to *Mabea* Aublet.

Study of the type at Paris (P) revealed that it does indeed belong to *Mabea taquari* Aublet. This synonymy was recognized by M. Emmerich (1970 in sched.), but remained unpublished. I therefore propose this new synonymy:

Mabea taquari Aublet, Hist. Pl. Guiane 2: 870, 4: pl. 334, fig. 2. 1775. TYPE: Guyane Française. Cayenne, *Aublet s.n.* (lectotype, designated here, BM; isolectotypes, G, P, W).

Maprounia glauca W. Hamilton, Prodr. Pl. Ind. Occid.: 54. 1825. Syn. nov. TYPE: Guyana. Without locality, Herb. *Desvaux s.n.* (holotype, P).

Because Hamilton mentioned only this one species, and no other species was ever described under *Maprounia*, *Maprounia* W. Hamilton becomes a synonym of *Mabea*.

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A New *Triraphis* (Poaceae: Eragrostideae) from Brazil: First Record of a Native Species in the New World

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ABSTRACT. *Triraphis devia* Filgueiras & Zuloaga from central Brazil is described as a new species, illustrated, and compared with morphologically similar species in the genus. Anatomical and ecological data are presented together with a biogeographical discussion. A tentative key to all the species of *Triraphis* is provided. This is the first record of a native *Triraphis* in Brazil and in South America.

During field excursions undertaken by the senior author and collaborators for the Biogeography of the Cerrado Biome project (Felfili et al., 1994) several grass species were collected that could not be identified. One of these grasses is herein described as a new species of *Triraphis* R. Brown.

Triraphis comprises seven species, six of which occur in Africa and one in Australia, always in savanna habitats, often in sandy or stony soils (Clayton & Renvoize, 1986; Watson & Dallwitz, 1992).

Triraphis devia Filgueiras & Zuloaga, sp. nov. TYPE: Brazil. Goiás: Chapada dos Veadeiros, município de Alto Paraíso, ca. 17 km da cidade, em direção a Colinas de Goiás, 14°09′30″S, 47°39′54″W, ca. 1200 m, ereto, cerca 60 cm de altura, campo limpo, 23 Nov. 1994, *T. S. Filgueiras & D. Alvarenga 3168* (holotype, IBGE; isotypes, F, ICN, K, MEXU, MO, SI, SP, US). Figures 1, 2.

T. andropogonoidi (Steudel) E. Phillips ex Africa similis autem culmis 12–49 cm longis, laminis 1.8–11.2 cm longis et 1.2–2.8 cm latis, panicula 2–6 cm longa, spiculis 4–8 flosculis absimilis.

Densely caespitose perennials. Rhizomes small, knotty. Culms 12–49 cm tall, erect, cylindrical, unbranched in the vegetative portion, delicate, fragile, with 1–2 elongated internodes; internodes 6.5–27.5 cm long, solid, filled with pith, glabrous, striate, stramineous to purplish, nodes darkish, glabrous. Leaves mostly basal, a few cauline; basal leaves strongly imbricate; basal sheaths 3.5–5.5 cm long, strongly keeled, glabrous, both margins hyaline, glabrous; cauline sheaths 3.5–5 cm long, keeled to round at the back, striate, margins hyaline, glabrous to sparsely pilose toward the apex; ligule a dense fringe of hairs, the hairs ca. 0.5 mm long, pale; the ligular hairs longer and denser at the extremities of the ligule; collar undifferentiated; auricles not present; blade 1.8–11.2 cm long and 1.2–2.8 mm wide, keeled to flat, linear, glabrous on both surfaces or with a few scattered hairs, strongly striate, surface rough, margins denticulate, apex naviculate to subnaviculate, the central nerve occasionally projected beyond the blade into an awn-like structure. Inflorescence an open, terminal panicle, 2–6 cm long and 1.6–4 cm wide (inclusive of awns), with 3–7 spikelets. Pedicels 5–18 mm long, scabrid. Spikelets 6–12 mm long and 5–9 mm wide (inclusive of awns), solitary or paired, laterally compressed, dark to purplish, 4–8-flowered, the apical floret reduced to a sterile lemma; glumes 2, persistent on the pedicel; lower glume 4–4.5 mm long, 1-nerved, rough along the nerve, apex acute, mucronate or aristate; mucro or awn 0.5–2.5 mm long; upper glume 4–4.5 mm long, 1-nerved, thinner than the lower glume, the apex 2-notched, the central nerve projected beyond the body of the glume into a straight mucro or awn, the mucro or awn 0.5–1.5 mm long; rachilla 0.5–0.8 mm long, well developed between the florets, pilose at the base; lemma 4–4.3 mm long, pilose at the base, 3-nerved, with 3 awns, two lateral and one terminal; lateral awns 4–5 mm long, originating from the lateral nerves, retrorsely barbed, straight, divergent; central nerve projecting into a straight awn, the awn 3.8–4.2 mm long, retrorsely barbed; apex of lemma deeply 2-notched, the lateral expanses acute to irregularly eroded at the apex; palea 4–4.5 mm long, 0.8–1.1 mm wide, strongly 2-keeled, hyaline, apex 2-notched; lodicules ca. ½ as long as the ovary, 2, fleshy, glabrous; ovary obconic, stipitate, pale; styles 3; lateral styles 0.5–0.8 mm long; the central

Figure 1. *Triraphis devia* Filgueiras & Zuloaga. —A. Habit. —B. Detail of apex of the blade. —C. Portion of the leaf in the ligular area. —D. Spikelet, lateral view. —E. Lower glume, dorsal view. —F. Upper glume, dorsal view. —G. Lemma, dorsal view. —H. Lemma and palea, ventral view. —I. Lemma, ventral view. —J. Palea with lodicules, ovary, and stamens. K, L. Caryopsis. —K. Embryo view. —L. Hilum view. (*Filgueiras & Alvarenga 3168.*)

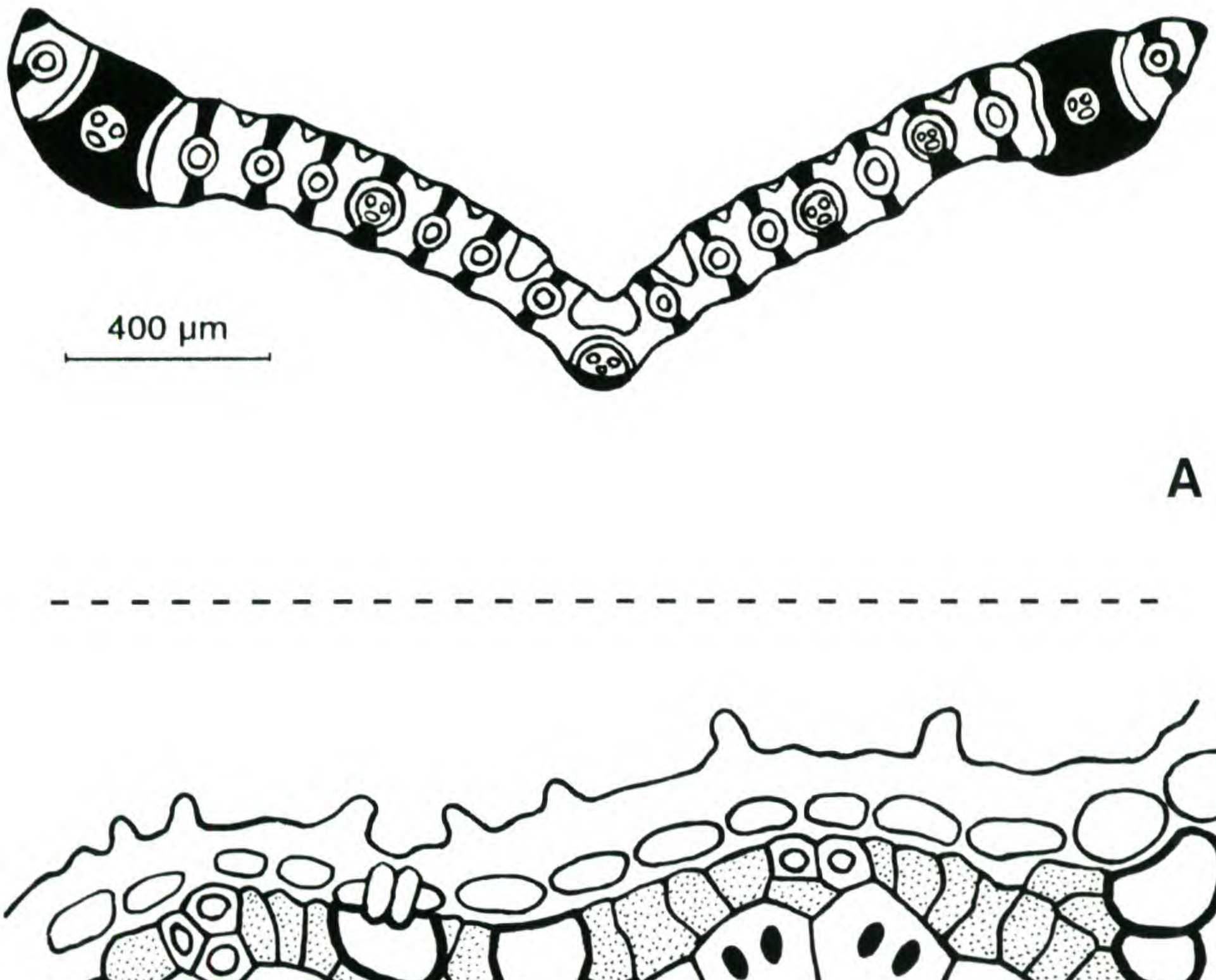

Figure 2. Leaf blade anatomy of *Triraphis devia*. —A. Blade outline showing V-shaped blade, with the central median bundle structurally distinguishable from the lateral first-order bundles; sclerenchyma conspicuous and associated with 1'vbs toward the margins. —B. Detail of radiate chlorenchyma, 1'vb and 2'vb with specialized chloroplasts in the outer bundle sheath. (*Filgueiras & Alvarenga 3168.*)

style 0.1–0.5 mm long; stigmas 2, at the apex of the lateral styles, purple; stamens 3, filament minute, pale, anthers 1.8–2 mm long, yellowish to tan. Apical floret reduced to a sterile lemma, occasionally the sterile lemma containing a minute, rudimentary sterile lemma inside. Caryopsis 1.8–3 mm long, ellipsoid, tan, with the 3 persistent stylar bases; embryo ca. ½ as long as the fruit; hilum ¼–⅓ as long as the caryopsis, dark, punctate-oblong, basal.

Paratypes. BRAZIL **Goiás:** Mun. Alto Paraíso, Parque Nacional Chapada dos Veadeiros, campo limpo, 28 Sep. 1995, *T. S. Filgueiras & F. C. A. Oliveira 3282* (B, BM, IBGE, P); Chapada dos Veadeiros, 17 km de Alto Paraíso/Colinas, Erva ca. 0.40 m de altura, campo limpo arenoso, 23 Nov. 1994, *M. Aparecida da Silva & F. C. A. Oliveira 2382* (IBGE, SP).

Leaf Anatomy

The standardized terminology of Ellis (1976, 1979) was used to describe the anatomical structure of the leaf blades. The following abbreviations are used in the anatomical description: vbs: vascular bundles; 1'vb(s): first-order vascular bundle(s); 2'vb(s): second-order vascular bundle(s); obs: outer bundle sheaths.

LEAF BLADE IN TRANSVERSE SECTION (FIG. 2)

Outline: V-shaped; two halves of lamina symmetrical about the median vascular bundle; leaf blade section includes between 18 and 20 vbs; adaxial and abaxial surface without ribs and furrows. *Midrib*: a definite keel; median vascular bundle structurally distinguishable from other 1'vbs. *Vascular bundle arrangement*: 3 2'vbs between consecutive lateral 1'vbs; all vbs positioned at the same level. *Vascular bundle description*: 1'vbs elliptical to subcircular in outline, circular metaxylem vessels narrow with diameters less than half those of the obs cells; 2'vbs elliptical in outline, with phloem and xylem distinguishable. *Vascular bundle sheaths*: outer Kranz parenchyma sheath conspicuous, regular in outline, continuous in 2'vbs, interrupted in 1'vbs by sclerenchyma girders toward both surfaces or only toward the abaxial surface; specialized chloroplasts present, of centrifugal position (?); adaxial and abaxial bundle sheath extensions absent. Inner mestome sheath entire, of small cells with uniformly thickened walls.

Sclerenchyma: small, inconspicuous sclerenchyma strands associated with all vbs, both adaxially and abaxially, except toward the margins where they are conspicuous and associated with first-order vascular bundles.

Mesophyll: chlorenchyma radiate, interrupted toward both surfaces by sclerenchyma girders, compactly arranged with a few intercellular air spaces; chlorenchyma cells tabular; 2–3 chlorenchyma cells between consecutive vbs. Arm cells absent. Fusoid cells absent.

Adaxial epidermal cells: bulliform cells conspicuous and associated with the median vascular bundle, fan-shaped and covering ½–¾ the width of the transverse section; also in small groups in adaxial furrows and between the vascular bundles. Epidermal cells small, regular in size, the cuticle thick and continuous; papillae and prickles present. *Abaxial epidermal cells*: bulliform cells absent; epidermal cells small; papillae absent; hooks present.

Discussion

This new species shares the following generic characters with other taxa included in *Triraphis*: inflorescence an open panicle, with spikelets laterally compressed, several flowers per spikelet, lower and upper glume 1-nerved, shorter than the spikelet, lemmas with three awns, and a similar leaf anatomy and Kranz syndrome. *Triraphis andropogonoides*, the closest relative of *T. devia*, can be distinguished by being rhizomatous plants, with long creeping rhizomes, the culms 120 cm tall, the leaves 20–40 cm long, inflorescences 12–30 cm long, and spikelets 5–15-flowered.

The following is a tentative key to distinguish the species in *Triraphis* (based on Gibbs Russell et al., 1990):

1. Plants annual 2
1′. Plants perennial 3
2(1). Spikelets 2–4 mm long; anthers 0.2–0.4 mm . . . . . *T. pumilio* R. Brown
2′. Spikelets 6–10 mm long; anthers 1.2–2 mm . . . . . *T. purpurea* Hackel
3(1). Culms profusely branched . . . . . *T. ramosissima* Hackel
3′. Culms not branched 4
4(3). Panicle 2–6 cm long . . . . . *T. devia* Filgueiras & Zuloaga
4′. Panicle 12–40 cm long 5
5(4). Plants up to 60 cm tall; panicle contracted; spikelets 4 mm long . . . . . *T. mollis* R. Brown
5′. Plants up to 140 cm tall; panicle open; spikelets 6–11 mm long 6
6(5). Panicle sparse; central awn of lemma longer than the lemma . . . . . *T. schinzii* Hackel
6′. Panicle dense; central awn of lemma shorter than the lemma . . . . . *T. andropogonoides* (Steudel) E. Phillips

The arrangement of mesophyll tissue, together with the presence of specialized chloroplasts in the outer bundle sheath cells, indicates that this new species has a Kranz, PS (=XyMs+) anatomy (terminology of Hattersley & Watson, 1976). Also, two or three chlorenchymatous mesophyll cells are found between successive vascular bundles, which further indicates a C_4 anatomical organization (Hattersley & Watson, 1975). This agrees with the anatomy described for *Triraphis* (Watson & Dallwitz, 1992). The position of the specialized chloroplasts, in the outer bundle sheath, was difficult to ascertain due to the absence of fresh material to carry on the anatomical observations. It is noteworthy to mention the presence of conspicuous sclerenchyma tissue toward both margins, combined with the presence of well-developed bulliform cells toward the keel of the blade; consequently, it is possible to conclude that the blades can be easily folded under water stress conditions.

Two populations of *Triraphis devia* were located during field excursions, one inside the Parque Nacional Chapada dos Veadeiros and the other along an unpaved road, between the town of Alto Paraíso and the village of São Jorge. The latter population is obviously under great threat because the area is used as a native pasture. In addition, erosion is beginning to eliminate the vegetation along the unpaved road, including plants of this new species. The population inside the Parque is legally protected. In both cases, the plants grew in stony soil, apparently extremely poor in nutrients. The vegetation where the species was found is classified as a campo limpo de cerrado (i.e., tropical seasonal shortgrass field of cerrado [Eiten, 1983]).

Almost all the plants seen had some leaves clipped. Cattle, horses, wild animals, and insects seem responsible for the leaf predation of *Triraphis devia*. These plants are evidently fire-resistant, since all populations examined displayed signs of fire damage.

The discovery of this new species of *Triraphis* in the high elevations (ca. 1200 m) of central Brazil is exciting and puzzling: exciting because no native species of this genus has ever been reported for South America. The only known record of a species of *Triraphis* in South America is that of *T. andropogonoides*, taken in Rio de Janeiro, Brazil, in 1833 (Filgueiras & Burman, in press). That record obviously represents a case of a furtive introduction that never became successfully established. *Triraphis andropogonoides*, a native of South Africa (Gibbs Russell et al., 1990), has never been reported or collected again in Rio de Janeiro or elsewhere in Brazil or South America (Nicora & Rúgulo, 1987; Watson & Dallwitz, 1992). This is also puzzling because it is the sole known species of a predominantly African genus in the New World, with a single species in Australia.

Regarding the plant and animal relationships between Africa, America, and Australia, two different points of view developed in the last decades. Thorne (1973), Smith (1973), and other authors emphasized differences between the continents and explained present disjunct distributions as examples of long-distance dispersal between Africa and America; consequently, the relationships between these continents are, according to these authors, derived mostly from immigration, supplemented by a few subsequent transatlantic long-distance dispersal events (Gentry, 1993). On the other hand, Raven and Axelrod (1974) showed, in their synthesis of angiosperm biogeography, that there are many examples, within angiosperms, of a vicariant distribution between Africa, South America, and Australia: e.g., the Proteaceae, Restionaceae, Podocarpaceae, Winteraceae, and other groups. A similar biogeographical pattern was summarized in the Annonaceae by Schatz and Le Thomas (1993), and in the Asteraceae by Bremer (1993). Zoological evidence seems to follow the same pattern. For example, the Lung-fishes of the group Dipnoi are represented today by only three genera, one from Australia, one from Africa, and another from South America (Greenwood, 1975).

Within the Poaceae, Clifford and Simon (1981) and Simon and Jacobs (1990) emphasized that *Triraphis* is a unique chloridoid genus with a disjunct distribution between Australia and Africa. They included a number of chloridoid genera as Gondwanan elements, such as *Chloris* Swartz, *Diplachne* Beauvois, *Enneapogon* Beauvois, and *Eragrostis* Wolf. Simon (1989) stressed that major groups were well dispersed throughout the world before the final breakup of the Gondwanaland supercontinent. Consequently, the present distribution of *Triraphis*, with one species in Australia, another in South America, and six species in Africa can be explained by a vicariant event, in which the genus evolved in arid areas after the breakup of the supercontinent Gondwana; Raven and Axelrod (1974) stated that "many of the endemic families and taxa of the two continents may have survived in, or later evolved in such edaphic deserts."

The specific epithet alludes to the fact that the plants of this new species are geographically deviated (*devius, a, um*) from other species in the genus.

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Una Especie Nueva de *Furcraea* (Agavaceae) de Chiapas, México

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RESUMEN. Se describe e ilustra por primera vez a *Furcraea niquivilensis*, del estado de Chiapas, México. Esta especie tiene afinidad con *F. macdougallii* pero difiere de ella por la forma de la hoja, la panícula piramidal, el tamaño mayor de las flores y forma y tamaño de los bulbilos.

ABSTRACT. *Furcraea niquivilensis* from Chiapas, Mexico, is described and illustrated for the first time. It is related to *F. macdougallii*, from which it differs by the shape of the leaves, the pyramidal panicle, as well as by the flower size, and shape and size of the bulbils.

Como parte de la revisión taxonómica del género *Furcraea* que se está realizando para México, se visitaron localidades del estado de Chiapas cercanas a la frontera con Guatemala, de donde provenían dos ejemplares de herbario estériles, colectados por Eizi Matuda en los años 1973–1974. Estos especímenes fueron identificados tentativamente por García-Mendoza y Lott (1994) como *F. macdougallii*; sin embargo, con la obtención de material fértil en el campo, se encontró que, se trata de una especie nueva que se describe a continuación.

Furcraea niquivilensis Matuda ex García-Mendoza, sp. nov. TIPO: México. Chiapas: Municipio de Motozintla, Barrio Tuchamen, 10 km al S de Niquivil camino a Pavincul, alt. 2347 m, 15°14′02″N, 92°12′43″W, 2 abr. 1997 (fl), *A. García-Mendoza, L. de la Rosa & A. Castañeda 6441* (holótipo, MEXU; isótipos, ENCB, K, MO). Figura 1.

Planta monocarpica arborescens; folia lanceolata (170–)190–210 cm longa, 12–14 cm lata, marginis dentibus 5–6(–8) mm longis, decurrentibus, supra infraque muricata, apice acuminata. Panicula pyramidalis, ramis primariis 2–2.3 m longis, secundariis 30–60 cm longis. Flores (7–)7.5–8 cm longi; bulbili (4–)5.5–6.5 cm longi, (3–)4.5–6(–6.5) cm lati, sphaeroidei vel late conici.

Plantas monocárpicas, arborescentes, troncos 1–3 m de alto, 30–40 cm de ancho, simples, con una roseta de hojas en el ápice, diámetro de la roseta en la parte media de 4–5 m; 80–150 hojas por roseta. Hojas (170–)190–210 × 12–14 cm, lanceoladas, erectas, verdes, las secas persistentes a lo largo del tronco, fibrosas, coriáceas, superficie del haz y envés escabrosa o muricada, base de la hoja angostándose hasta 7–8.5 cm, en corte transversal depreso-obovada, de 5–5.5 cm de grosor, ápice con mucrón de 1–4 mm, castaño oscuro; margen recto, dentado, dientes de 5–6(–8) mm de largo, 3–4 mm de ancho en la base, decurrentes, por lo que el margen llega a ser córneo, sobre pequeñas mamilas, antrorsos o rectos en la base, retrorsos en la parte media y antrorsos en la parte superior, castaños con la base amarillenta, separados entre sí por (1–)2–4 cm a la mitad de la hoja y por 0.6–1.5(–2) cm en la base. Panículas de 6–9 m de alto, bulbilíferas, piramidales; pedúnculos de 1.5 m de longitud, verdes, puberulentos; ramas primarias de 2–2.3 m de largo, puberulentas, ramas secundarias de 30–60 cm de largo, puberulentas. Flores (7–)7.5–8 cm de largo, en fascículos de 1–3; pedicelos 0.5–1 cm, puberulentos; tépalos externos (3–)4–4.5 × 1.1–1.3 cm, oblongos, glabrescentes, los internos 4–4.5 × 1.2–1.4 cm, oblongos, glabrescentes sobre la prominente vena media, papilosos en el área de sobreposición, ambos de color verde-blanquecino con tintes rojizos en la parte externa, blanquecinos por dentro; estambres 2–2.5 cm de largo, 5–8 mm en su parte más engrosada, papilosos en la base, de color verde-amarillento; anteras 4–6 mm de largo, 2–3 mm de ancho, oblongas, amarillas; ovario 3.6–3.8 × 0.4–0.6 cm, cilíndrico, puberulento, verde; estilo 2.5–2.8 cm de largo, 0.6–0.8 mm en la base, trisulcado, papiloso, verde-amarillento, estigma entero, en ocasiones ciliado. Bulbilos (4–)5.5–6.5 cm de alto, (3–)4.5–6(–6.5) cm de ancho, esferoides a ampliamente cónicos, cubiertos por 4–6 brácteas ampliamente ovadas, pardas, cartáceas, persistentes. Frutos y semillas desconocidos.

Etimología y usos. El epíteto específico alude a la región principal donde crece la especie, poblada por el grupo étnico Mame, quienes la conocen con el nombre genérico de maguey y la plantan como cerco para delimitar sus terrenos y evitar la erosión del suelo; así mismo, utilizan las fibras de las hojas para hacer canastos y cuerdas, actividad

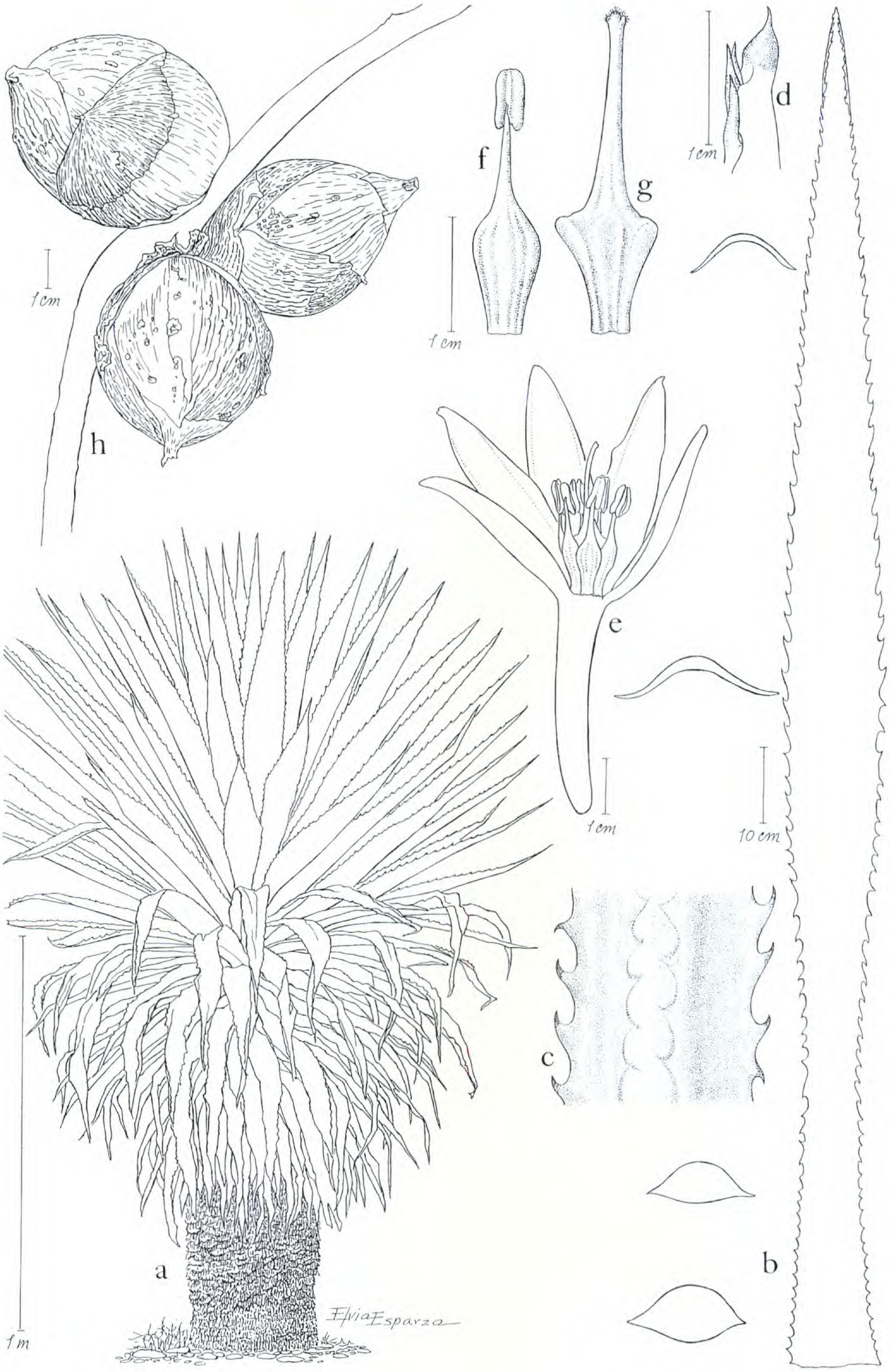

Figure 1. *Furcraea niquivilensis* Matuda ex García-Mendoza. —a. Planta completa. —b. Hoja y sus secciones transversales. —c. Corte de la hoja, mostrando el envés muricado. —d. Mucrón. —e. Flor con tépalos abiertos. —f. Estambre. —g. Estilo. —h. Rama con bulbilos. Ilustración basada en el especimen *García-Mendoza et al. 6441.*

que se realiza en muy baja escala en la actualidad, pero que fue sobresaliente en el pasado.

Distribución y hábitat. *Furcraea niquivilensis* se ha encontrado hasta el momento únicamente como planta cultivada cerca de las poblaciones; sin embargo, es posible que aún crezca dentro de los bosques de *Pinus–Quercus* o bosques mesófilos de montaña de la región circundante, tanto de Chiapas como del vecino Departamento de San Marcos en Guatemala. En la actualidad estos bosques se encuentran muy perturbados y no se encontraron ejemplares de esta especie creciendo en forma silvestre. Las plantas cultivadas crecen en laderas hasta de 50° de pendiente, sobre suelos arenosos de color pardo y en altitudes que oscilan entre los 1800 y 2650 m snm.

Relaciones taxonómicas. *Furcraea niquivilensis* y *F. macdougallii* Matuda, tienen características morfológicas similares, como son, la presencia de tallo, superficie de la hoja escabrosa o muricada por el haz y el envés; superficie puberulenta en ramas primarias, secundarias, pedicelos de las flores y ovarios. Sin embargo, difieren en varios atributos importantes que se señalan a continuación.

Las hojas de *F. niquivilensis* son lanceoladas y presentan una relación entre el largo y el ancho de 13–15:1, mientras que, *Furcraea macdougallii* tiene hojas lineares, con una relación largo-ancho de 19–21:1. Los dientes del margen de la hoja en *F. niquivilensis* miden 5–6(–8) mm y el ápice es acuminado, mientras que, en *F. macdougallii* los dientes del margen miden 2–4 mm y el ápice es largamente acuminado. La panícula en *F. niquivilensis* tiene forma piramidal, con las ramas primarias de 2–2.3 m y las ramas secundarias de 30–60 cm de largo; en contraste, la panícula de *F. macdougallii* es romboidal, las ramas primarias miden 1–1.5 m de largo y las ramas secundarias 15–26 cm. También difieren en el tamaño de las flores, ya que, en *F. niquivilensis* éstas alcanzan tamaños de 7.5–8 cm de largo y en *F. macdougallii* son de 3–3.5(–4) cm. Por último, una diferencia conspicua entre ambas especies se observa en el tamaño y forma de los bulbilos; en *F. niquivilensis* son esferoides o ampliamente cónicos y miden de (4–)5.5–6.5 cm de alto por (3–)4.5–6(–6.5) cm de ancho, en tanto que, los bulbilos de *F. macdougallii* son cónicos y miden 3–5(–6) cm de alto por 1–1.5 cm de ancho. De hecho, *F. niquivilensis* posee, los bulbilos más grandes conocidos para cualquier especie de *Furcraea* en México y Centroamérica y quizá sean los bulbilos mayores en tamaño de todo el género.

Furcraea macdougallii, es una especie restringida a la Mixteca Baja en los límites de Puebla y Oaxaca y posiblemente al Istmo de Tehuantepec, área de donde fue descrita originalmente, pero donde no se le ha visto más. Crece sobre suelos arenosos de origen calizo, en altitudes entre los 750 y 1200 m snm. Se le conoce sólo de ambientes secundarios derivados de la selva baja caducifolia espinosa, donde convive con *Agave marmorata* Roezl, *Ceiba parvifolia* Rose, *Haematoxylum brasiletto* Karst, *Hechtia glomerata* Zuccarini, *Myrtillocactus geometrizans* (C. Martius) Console, *Neobuxbaumia tetetzo* (F. A. C. Weber) Backeberg, *Plumeria rubra* L. y *Tabebuia guayacan* (Seemann) Hemsley.

En el estado de Chiapas crecen cuatro especies de *Furcraea* adicionales. *F. quicheensis* Trelease, se reconoce por sus hojas glaucas, con margen finamente denticulado, flores glabras, verdes y cápsulas oblongas. *Furcraea samalana* Trelease, se caracteriza porque sus hojas no tienen dientes en la mitad o ⅔ superiores, la inflorescencia es laxa con flores blanquecinas y bulbilos foliosos. Ambas especies son endémicas de Chiapas y Guatemala. Trelease (1915) describió *F. guatemalensis* y aunque García-Mendoza y Lott (1994) mencionan que crece en Chiapas, hasta el momento no se le ha hallado; los especímenes de herbario identificados con este nombre posiblemente correspondan a una especie nueva. Existe un taxon más, cuya circunscripción taxonómica y nomenclatural está aún bajo estudio.

Paratipos. MEXICO. **Chiapas**: Municipio de Motozintla, Zaragoza, 36 km al SE de Motozintla y 10 km al S de Niquivil, alt. 2720 m, 15°14′16″N, 92°13′51″W, 2 abr. 1997, *A. García-Mendoza, L. de la Rosa & A. Castañeda 6439* (MEXU); Municipio de Motozintla, Barrio de Tuchamen, 10 km al S de Niquivil camino a Pavincul, alt. 2347 m, 15°14′02″N, 92°12′43″W, 2 abr. 1997, *A. García-Mendoza, L. de la Rosa & A. Castañeda 6440* (CHIP, ENCB, MEXU, TEX), *6442* (DES, ENCB, MEXU, XAL), *6443* (ENCB, MEXU, MO, UAMIZ, US), *6444* (ENCB, MEXU), *6445* (MEXU), *6446* (MEXU); Barrio Tonincanaque, 8 km al S de Niquivil camino a Pavincul, 2650 m, 15°14′55″N, 92°13′28″W, 2 abr. 1997, *A. García-Mendoza, L. de la Rosa & A. Castañeda 6448* (MEXU); Allende, 12 km al NO de Niquivil camino a Motozintla, 2137 m, 15°19′07″N, 92°14′11″W, 2 abr. 1997, *A. García-Mendoza, L. de la Rosa & A. Castañeda 6455* (MEXU); Aserradero viejo, entre Tolimán a Niquivil, alt. 1800 m, 24 ene. 1973, *E. Matuda 38517* (MEXU); Orilla de arroyo rocoso en bosque de pinos, 13 abr. 1974, *E. Matuda 38625* (MEXU).

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A New Species of Chinese *Adenophora* (Campanulaceae)

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ABSTRACT. *Adenophora ningxianica* is described, and its relationships to *A. wawreana* Zahlbruckner and *A. gmelinii* (Sprengel) Fischer are discussed.

The name *Adenophora ningxianica* Hong, which first appeared in Hong (1983) and subsequently in many local Chinese floras, was not validly published because it was not accompanied by a Latin description or diagnosis. It is herein validated, and a detailed description in English is provided.

Adenophora ningxianica Hong ex Ge & Hong, sp. nov. TYPE: China. Ningxia: Ala (Helan) Mountains, Taszekow, 1600 m, 28 Aug. 1933, *Y. Y. Pei 120* (holotype, PE).

Species similis *A. wawreanae* et *A. gmelinii*, sed ab illa differt foliis sessilibus glabris, capsula tenui cylindrica ca. 8 mm longa, seminibus majoribus; ab hac differt corolla parva et angusta, stylo exserto, calycis lobis angustis parvis et nigro-callosis.

Perennial herbs. Stems 30–50 cm tall, several from base, unbranched, erect, glabrous, rarely pubescent. Basal leaves cordate or obovate; cauline leaves alternate, sessile or short petiolate; leaf blade 2–7 cm long, 0.2–1.8 cm wide, lanceolate to linear-lanceolate or rarely linear, glabrous on both surfaces, base cuneate, margin serrate. Inflorescences few-flowered racemes or panicles. Pedicel 0.5–1.5 cm long, slender. Calyx tubes obovoid, glabrous; calyx lobes 2–6 mm long, ca. 1 mm wide, subulate or subulate-lanceolate, margin mostly with a pair of small verrucate teeth or rarely entire. Corolla 1.4–1.6 cm long, narrowly campanulate, blue or purplish blue; lobes ca. 3.5 mm long, ovate-triangular. Disc 2–2.5 mm long, tubular, glabrous. Style 1.6–1.8 cm long, slightly exserted. Capsule ca. 8 mm long, ca. 3 mm diam., long ellipsoid. Seeds ca. 2 mm long, yellow, oblong, with a wing-like ridge. Flowering July–August, fruiting September–October.

Adenophora ningxianica is most closely related to *A. wawreana* Zahlbruckner and *A. gmelinii*. From these, it differs in having a narrower corolla, a slightly exserted style, sessile or short-petiolate and glabrous cauline leaves, smaller calyx lobes with toothed margins, slender capsules, and larger seeds. *Adenophora wawreana* has a broadly campanulate corolla, a distinctly exserted style, pubescent cauline leaves with petioles ca. 2.5 cm long, 4–10-mm-long calyx lobes, broader capsules, and seeds 0.8–1.2 mm long. *Adenophora gmelinii* differs from *A. ningxianica* in having a broadly campanulate corolla, a slightly included style, entire and wider calyx lobes, and broader capsules 4–7 mm in diameter.

Paratypes. CHINA. **Ningxia:** Helan Mt., Suyukou, *Y. Q. He 7315* (PE); Helan Mt., Wudaotai, *Yellow River Exped. 8950* (PE); Helan Mt., Gilawu Vellay, *Group He 255* (PE). **Gansu:** Lanzhou, Xinlong Mt., *Y. Q. He 5390* (PE).

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The Identity of *Taraxacum altune* D. T. Zhai & Z. X. An

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ABSTRACT. *Taraxacum altune* D. T. Zhai & Z. X. An is reduced to synonymy of *Crepis minuta* Kitamura.

The recently described *Taraxacum altune* (Zhai & An, 1995) was based on a flowering specimen collected by Y. H. Wu in 1988. During the revision of *Taraxacum* for *Flora Reipublicae Popularis Sinicae*, we examined additional specimens of the same species, including fruiting material. The achenes of this material are blackish, cylindric, narrowed toward the apex, beakless, smooth, and ribbed, and the scapes have a small leaf. In *Taraxacum* the leaves are all basal, and the achenes are fusiform to oblanceolate, often spinulose near the apex, usually slender-beaked, and clearly with a more or less swollen region between the beak and body. Therefore, plants of *T. altune* represent a species of *Crepis* L. Critical comparison of the type material of *T. altune* with Chinese species of *Crepis* (Tang, 1985) reveals that *T. altune* is conspecific with *Crepis minuta* Kitamura. The type of *C. minuta* was collected by Kawaguchi (SM 96895, now TNS) from Xizang (Tibet).

Crepis minuta Kitamura, Acta Phytotax. Geobot. XV: 70. 1953.

Taraxacum altune D. T. Zhai & Z. X. An, J. Aug. 1st Agri. College. 18(3): 1. 1995. Syn. nov. TYPE: China. Xinjiang: Qiemo, *Y. H. Wu 2644* (HNWP).

Additional material examined. CHINA. **Xizang:** Nagarze, *Qinghai-Xizang Exped. 74–2061* (KUN).

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Zhai D. T. & An Z. X. 1995. New Species of *Taraxacum* from Xinjiang. J. Aug. 1st Agri. College. 18(3): 1–5.

Four New Species of *Memora* (Bignoniaceae) from South America[1]

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ABSTRACT. Four new South American species of *Memora* (*M. cidii*, *M. contracta*, *M. sastrei*, and *M. velutina*) are described and three are illustrated. *Memora cidii* has flattened inflorescence axes, campanulate calyces, and bracteoles extending beyond the calyx tip. Glands at the base of the corolla lobes distinguish *M. contracta*, and *M. sastrei* is unique in having conspicuous yellow-dendroid pubescence on its inflorescence axes and calyces. *Memora velutina* is distinguished by pilose pubescence throughout. Relationships of these species to other *Memora* species are discussed.

Memora Miers (Bignoniaceae) is a genus of 32 species of lianas, scandent shrubs, or treelets found in tropical South America east of the Andes (Gentry, 1977, 1982, 1997). *Memora* is distinguished from other genera of tribe Bignonieae by the combination of terete branchlets and pinnately or bipinnately compound leaves (Gentry, 1978). *Memora* species produce showy, yellow to red, tubular-funnelform corollas, linear-oblong to oblong-orbicular dehiscent capsules, and bialate to corky seeds (Gentry, 1977, 1997). Gentry and Tomb (1980) suggested that *Adenocalymna*, *Memora*, and two species of *Tanaecium* may compose a "basically natural group" because most of these species share medium-textured yellow corollas, simple tendrils, and primarily biseriate ovules.

During preparation of a review of *Memora*, specimens annotated by A. H. Gentry were discovered that were neither described fully nor published validly. Although Gentry did not publish them before his untimely death, these taxa represent evolutionary units suitable for recognition as species. In a draft of his *Flora de Colombia* treatment of Bignoniaceae, Gentry described *Memora sastrei* but did not provide a Latin description or diagnosis. The other three *Memora* species presented here, *M. cidii*, *M. contracta*, and *M. velutina*, had no written descriptions and few notes pertaining to their circumscription.

1. Memora cidii A. H. Gentry ex Hauk, sp. nov. TYPE: Brazil. Amazonas: Mun. of Novo Aripuana, BR 230, Rod. Transamazonica, 400 km from Humaitá, 07°15′S, 60°00′W, 4 May 1985, *C. Ferreira 6013* (holotype, MO!; isotypes, NY!, US!). Figure 1.

Frutex scandens, ramulis teretibus glabris sine consocibus glandularibus in nodis interpetiolaribus. Folia opposita imparipinnata compositis foliolis 1–3 jugatis ovatis-ellipticis obtusis; pseudostipulis inconspicuis glandulosis. Inflorescentia paniculata axillaris; bracteolis cupulatis. Flos calyce truncato campanulato extus glanduloso apice puberulo duabus bracteolis subtentus; corolla tubuloso-infundibuliformi tubo glabro; thecis antherarum divaricatis; ovario oblongo lepidoto; disco pulvinato. A speciebus aliis rhachidibus et pedunculis complanatis olivaceis, inflorescentiae bracteolis triangularibus caducis differt.

Lianas; branches drying tan to brown, not striate, glabrate, the surface rough, with interpetiolar glandular fields lacking and interpetiolar transverse ridge inconspicuous or absent, lenticels not evident; pseudostipules persistent, subfoliaceous, ovate-oblong, 4–5 × 2–3 mm, glandular, glabrate. *Leaves* opposite, estipulate, petiolate, 50–55 cm long, 2–3-pinnate with a pair of opposite pinnae and the terminal pinna often modified into a tendril, each pinna imparipinnate with 1–3 sets of opposite simple or compound pinnules, the terminal segment somewhat larger than the lateral segments; petioles 4–6 cm long, terete, glabrate; petiolules 1–3 cm long, inconspicuously sulcate, glabrate; ultimate segments entire, ovate to ovate-elliptic, 16–22 × 7–11 cm, equilateral, plane, chartaceous, glabrate, apically obtuse, basally oblique to broadly acuminate, the venation brochidodromous with 8–10 principal vein pairs, marginally plane; joints of the compound leaf conspicuously enlarged. *Inflorescences* elongate, axillary racemes to 15 cm long, branched, several- to many-flowered; rachis and peduncles flattened, glabrate, and bracteate, the bracts triangular, 4–6 × 1–2 mm, caducous, minutely glandular, glabrate with ciliate margins; pedicels 1–2 mm long, glabrate; bracteoles ovate-ellip-

[1] This paper is number 8 of the GENTRY INVITATION SERIES, in acknowledgment of the contributions to the study of the Bignoniaceae made by Alwyn H. Gentry.

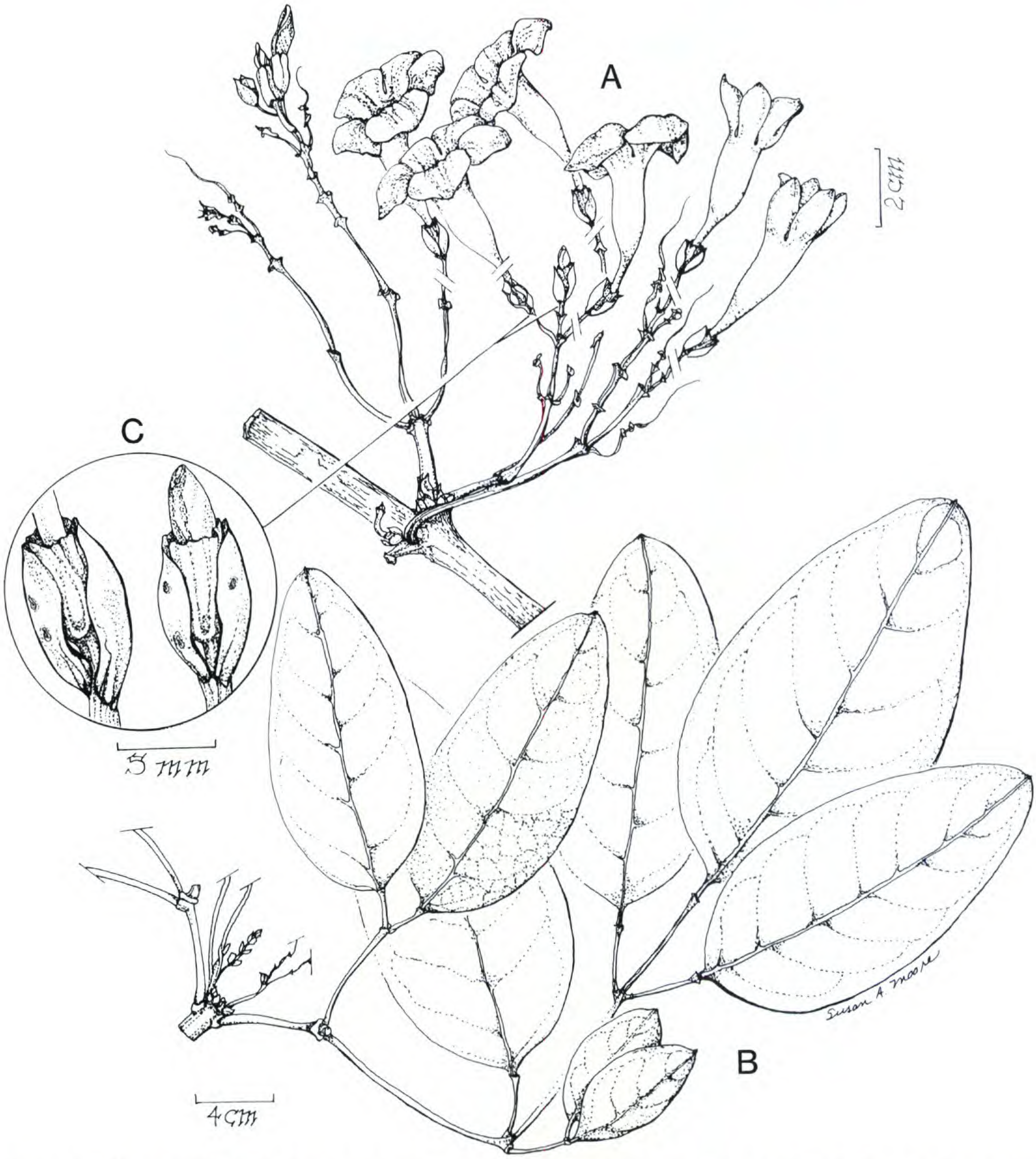

Figure 1. *Memora cidii* A. H. Gentry ex Hauk. —A. Inflorescence and stem. —B. Leaf. —C. Calyx with two subtending bracteoles. (From *C. Ferreira 6013*, MO, NY, US.)

tic and cupular, 8–11 × 4–5 mm, glandular, glabrate with ciliate margins, extending beyond the calyx tip. *Flowers* ovoid in bud; calyx campanulate, 5–8 × 5–6 mm, eglandular, costate, the outer calyx surface glabrate, the inner surface gland-tipped pubescent, the margin ciliate and intact, apically truncate except for 5 minute teeth; corolla zygomorphic, tubular-funnelform, yellow, exserted ca. 45 mm beyond the level of the calyx lip (50–55 mm total length), 2–3 mm wide at the calyx mouth, with an inner ring of flattened gland-tipped pubescence 8–10 mm from the corolla tube base, otherwise glabrate; corolla lobes 5 (2 upper and 3 lower), short-orbicular, 12 × 12 mm, the inner surface glandular-lepidote, the outer surface glabrate, no glandular fields present at the base of each lobe; fertile stamens didynamous, ca. 15 or 25 mm long, inserted near the level of the calyx lip, the single staminode inserted near the level of the fertile stamens; fertile anthers with two spreading thecae, included, glabrous; disc present, 1 mm tall; ovary 5 mm long, cylindrical, glabrate to minutely lepidote;

style 25 mm long; stigma bipartite and included. *Fruit* unknown.

Distribution. Known only from Amazonas, Brazil. Elevation unknown. Collected in terra firme soil.

Phenology. The sole collection was in flower in May.

Memora cidii is known only from the type collection. An unusual character of *M. cidii* is that the inflorescence axes are flattened, as is found (to a lesser extent) in *M. bracteosa* (DC.) Bureau & K. Schumann, *M. mollis* A. H. Gentry, and *M. racemosa* A. H. Gentry. *Memora cidii* has a more highly branched inflorescence than do *M. bracteosa* and *M. racemosa*. *Memora cidii*, *M. mollis*, and *M. racemosa* share campanulate, ribbed calyces, but *M. cidii* differs from *M. racemosa* and *M. mollis* in having bracteoles that extend beyond the calyx. *Memora cidii* has much smaller bracteoles than *M. bracteosa*. The inflorescence bracts of *M. cidii* and *M. racemosa* are generally caducous, whereas those of *M. bracteosa* and *M. mollis* are persistent. Further insights into the affinities of *M. cidii* await study of fruit, seed, and pollen characters.

2. Memora contracta A. H. Gentry ex Hauk, sp. nov. TYPE: Brazil. Rondônia: Município de Ariquemes, Minerarção Mibrasa, Setor Alto Candeias, km 128, 16 May 1982, *L. O. A. Teixeira et al. 502* (holotype, MO). Figure 2.

Frutex scandens, ramulis teretibus glabris sine consocibus glandularibus in nodis interpetiolaribus. Folia opposita imparipinnata foliolis 1–2 jugatis ellipticis acutis; pseudostipulis foliaceis ellipticis glandulosis. Inflorescentia racemosa-paniculata axillaris; bracteolis cupulatis. Flos calyce subspathaceo extus glanduloso puberulo duabus bracteis puberulis subtentus; corolla tubuloso-infundibuliformi tubo glabro; thecis antherarum divaricatis; ovario oblongo lepidoto; disco pulvinato. A speciebus aliis lobulis corollinis glandulis elevatis subtentis, pseudostipulis foliaceis ellipticis differt.

Lianas; branches brown to gray, not striate, glabrate to uncinate, with interpetiolar glandular fields lacking and interpetiolar transverse ridge present, lenticels evident; pseudostipules persistent, foliaceous, ovate-elliptic, 1–3 × 0.3–1.5 cm, glandular, glabrate to uncinate-puberulent, with prominent veins converging at the base. *Leaves* opposite, estipulate, petiolate, 27–50 cm long, imparipinnate with 2–4 pairs of opposite pinnae, tendrils not observed; petioles 4–8 cm long, terete to slightly sulcate, minutely uncinate-puberulent; petiolules 0.3–2.0 cm long, sulcate, uncinate-puberulent; ultimate segments entire, 14–22 × 3.5–10 cm, mostly elliptic to ovate, equilateral, plane, chartaceous, uncinate-puberulent, apically acuminate to acute-acuminate, basally acute to acuminate, the venation brochidodromous with 5–7 principal vein pairs, marginally slightly undulate; joints of the compound leaf conspicuously enlarged. *Inflorescences* compact, axillary racemes to 10 cm long, unbranched, several-flowered; rachis and peduncles terete, minutely puberulent and bracteate, the bracts linear-elliptic, 5–10 × 1–3 mm, glandular, glabrate to minutely puberulent; pedicels 1–3 mm long, minutely puberulent; bracteoles elliptic, 5–12 × 4–6 mm, glandular, minutely puberulent, extending ¼–¾ the length of the calyx. *Flowers* ovoid in bud; calyx bilabiate-subspathaceous, 14–18 × 5–6 mm, glandular, ecostate, the outer calyx surface glabrate to minutely puberulent, the inner surface glabrate, the margin splitting irregularly ¼–⅓ the length of the tube, the valves apically acute with 5 minute teeth; corolla zygomorphic, tubular-funnelform, yellow, exserted ca. 55–60 mm beyond the level of the calyx lip (65 mm total length), 3–5 mm wide at the calyx mouth, with an inner ring of pilose pubescence 10–20 mm from the corolla tube base; corolla lobes 5 (2 upper and 3 lower), irregularly orbicular, 15 × 15 mm, the inner surface lepidote-glandular, the outer surface glabrate, raised glandular fields at the base of each lobe; fertile stamens didynamous, 15 or 22 mm long, inserted 10 mm beyond the level of the calyx tip, the single staminode ca. 5 mm long, inserted at the same level as the fertile stamens; fertile anthers with two spreading thecae, included, glabrous; disc 1 mm tall; ovary 4 mm long, cylindrical, sparsely lepidote; style ca. 40 mm long; stigma bipartite and included. *Fruit* linear-oblong, 9–20 × 2.5–3.0 cm, the valves flattened but not conspicuously thickened, ≤ 4 mm thick, the margins not obviously serially constricted, drying dark brown, the midline evident but inconspicuous, the surface smooth to verrucate, many-seeded; seeds flattened, 2.5–3.0 × 2.0 cm, 2–4 mm thick, irregularly quadrate, wingless, the body not distinct.

Distribution. Known from Brazil and Venezuela. The Brazilian collections were made at 650 m, in terra firme forests.

Phenology. Ten fertile collections of *M. contracta* are known. Single flowering collections are from May, August, and September, and two collections each are from October and November. All three fruiting collections are from November.

Three of the collections examined were identified initially as *M. schomburgkii*, to which *M. contracta* is closely related. However, the presence of glandular fields at the base of the corolla lobes in

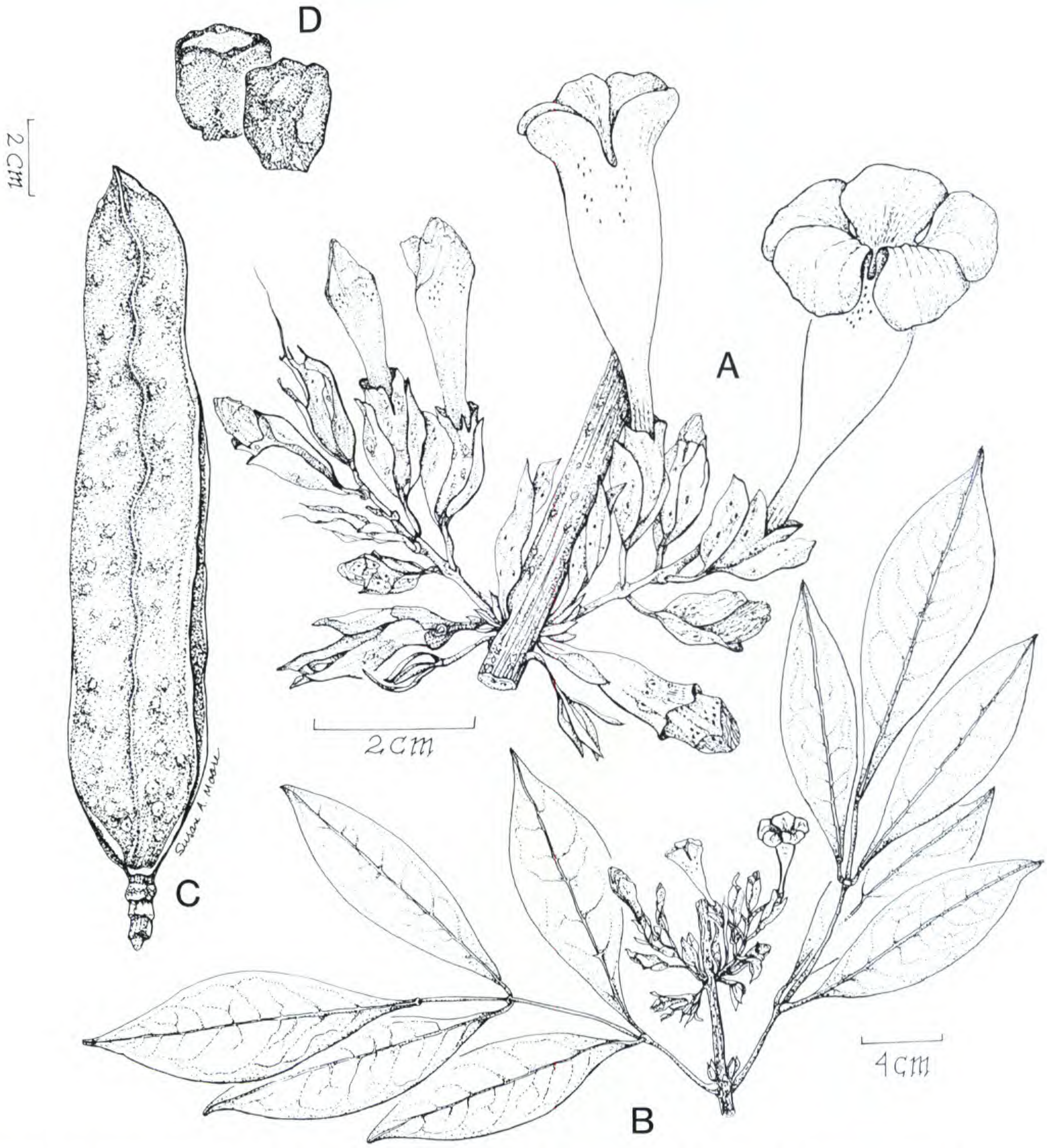

Figure 2. *Memora contracta* A. H. Gentry ex Hauk. —A. Inflorescence and stem. —B. Leaves and inflorescence. —C. Fruit. —D. Seed, proximal and distal sides. (A, B from *Vieira et al. 469*, MO; C, D from *dos Santos et al. 169*, MO.)

M. contracta clearly differentiates the two species (Fig. 2). As in *M. schomburgkii*, the calyx of *M. contracta* (Fig. 2) is bilabiate to subspathaceous, but it is generally smaller than that of *M. schomburgkii*. The fruits of *M. schomburgkii* are longer than those of *M. contracta*, and its seeds thicker. The pseudostipules of *M. contracta* are unique in *Memora* for their size, elliptic shape, and conspicuous venation. Vegetatively, *M. contracta* resembles *M. aspericarpa* A. H. Gentry, but the latter has less conspicuous bracts and bracteoles, and thicker fruit and seeds.

Paratypes. VENEZUELA. **Bolívar:** Dtto. Sifontes, 16–17 Sep. 1989, *M. Colella et al. 1447* (NY, MO!). BRAZIL. **Amazonas:** Manaus–Pôrto-Velho highway, km 124, 25 Mar. 1974, *D. G. Campbell et al. P20910* (MO!); Rio Tarumã, 26 Nov. 1974, *A. Gentry & J. Ramos 12864* (MO); Mineração, Campo Novo, 16 Oct. 1979, *C. Vieira et al. 469* (MO!). **Pará:** 18 km from Tucuruí, 1 Nov. 1981, *D. C. Daly et al. 1171* (MO!); Parauapebas, Reserva Biológica da Serra dos Carajás, 20 Nov. 1991, *G. dos Santos et al. 169* (MO!); Parauapebas, Reserva Biológica da Serra dos Carajás, 21 Nov. 1991, *G. dos Santos et al. 191* (MO!), *192* (MO!), *193* (MO!). **Rondônia:** Pôrto Velho–Cuiabá highway, 10 km S of Ariquemes, 14 Aug. 1968, *E. Forero & B. L. Wrigley 7057* (INPA, MG,

MO!); Mineração Taboca at Massangana, 11 Oct. 1979, *J. L. Zarucchi et al. 2674* (JBSD, MO!).

3. Memora sastrei A. H. Gentry & Hauk, sp. nov. TYPE: Colombia. Amazonas: Río Igará-Paraná, La Chorrera, reste de fôret primaire, 22 Sep. 1973, *Sastre 2293* (holotype, COL; isotypes, MO, P).

Frutex scandens, ramulis teretibus glabris sine consocibus glandularibus in nodis interpetiolaribus. Folia opposita, pinnata foliolis 3–5 ellipticis vel elliptico-ovatis scabre pubescentia; pseudostipulis carentibus. Inflorescentia racemosa compacta axillaris dense pubescentia dendroideis flavidis; bracteolis deciduis. Flos calyce tubuloso-campanulato irregulariter bilabiato apice glanduloso dense pubescente trichomatibus dendroideis flavidis duabus bracteolis glandulosis sicut calyce inflorescentiaque pubescentibus subtentus; corolla tubuloso-infundibuliformi. A speciebus aliis pubescentia dendroidea flavida, calyce apice glanduloso differt.

Arbolito 5–8 m de alto, las ramitas subteretes o un poco angulosas, sin seudoestípulas. *Hojas* pinnadas con 3–5 folíolos elípticos a elíptico-ovados, subagudos a subtruncados en la base (ápice desconocido), 13–30 cm de largo, 6–14 de ancho, coriáceos, bulados, las nervaduras primarias, secundarias, y terciarias conspicuamente impresas por encima y prominente por debajo; glabras en la haz, escabro no-pubescente en el envés, apareciendo blanquecino por la densa pubescencia, con tricomas largos, simples y ramificados, y tricomas cortos, dendroides. *Inflorescencia* en racimo corto, axilar, densamente pubescente con tricomas dendroides canela-amarillentos, las flores subtendidas por bractéolas 5–7 mm de largo, tempranamente deciduas. Cáliz tubular-campanulado, 20–26 mm de largo, 8–15 de ancho, irregularmente bilabiado, densamente pubescente con tricomas dendroides de color canela y glándulas con forma de plato cerca del ápice; corola amarilla, tubular-infundibuliforme o tubular-campanulada, 8–11 cm de largo, 15–25 mm de ancho en la boca del tubo, los lobos casi 2 cm de largo. *Cápsula* desconocida.

Esta especie esta muy emparentada con *M. cladotricha*, pero difiere notablemente por la pubescencia mucho más gruesa, especialmente en el cáliz y la superficie inferior de las hojas, las bractéolas más pequeñas y los folíolos más bulados. *Memora cladotricha* puede tener el nervio medio y los secundarios impresos por la haz y prominente por el envés, pero la venación más fina es uniformemente promínula por debajo y promínula a subplana por encima. El tipo de *M. cladotricha* es más pubescente que la mayoría de los otros ejemplares del taxón y, por ende, intermedio entre *M. sastrei* y la mayoría de las colecciones ubicadas en *M. cladotricha*.

The description and discussion of *Memora sastrei* provided here were originally written in English by A. H. Gentry, and then translated into Spanish. Unfortunately, the original English description could not be located. Gentry visited COL and P during the period that he wrote the *Flora de Colombia* treatment, and he annotated the holotype and presumably examined all the isotypes. The duplicates at MO are only fragmentary and could not be the basis for the description presented here. Gentry did not provide a Latin description or diagnosis of *M. sastrei* in the *Flora de Colombia* manuscript; the Latin description was provided by the author.

Paratypes. COLOMBIA. **Amazonas:** Río Igara-Paraná, La Chorrera, layon conduisant à la Sabana, km 1, 18 Sep. 1973, *Sastre 2246* (MO, P).

4. Memora velutina A. H. Gentry ex Hauk, sp. nov. TYPE: Brazil. Pará: BR 230, Transamazonian highway, 188 km W of Altamira, 30 Nov. 1977, *G. T. Prance, A. S. Silva, M. J. Balick, A. J. Henderson, B. W. Nelson & R. P. Bahia P25891* (holotype, MO; isotypes, NY, US). Figure 3.

Frutex scandens, ramulis teretibus dense pilosis sine consocibus glandularibus in nodis interpetiolaribus. Folia opposita bipinnata foliolis ovato-ellipticis obtusis; pseudostipulis foliaceis orbiculato-cordatis sparsim pilosis glandulosis. Inflorescentia racemosa pendula axillaris; bracteolis cupulatis. Flos calyce campanulato apice truncato minute 5-denticulato extus glanduloso duabus bracteolis foliaceis glandulosis subtentus; corolla tubuloso-infundibuliformi tubo glabro; thecis antherarum divaricatis; ovario oblongo lepidoto; disco pulvinato. A speciebus aliis ramulis dense pilosis differt.

Lianas; branches drying yellowish green, not striate, conspicuously pilose, with interpetiolar glandular fields lacking and interpetiolar transverse ridge present, lenticels inconspicuous or absent; pseudostipules persistent, foliaceous to subfoliaceous, elliptic to cordate-orbicular, 4–20 × 3–20 mm, glandular, sparsely pilose with ciliate margins. *Leaves* opposite, estipulate, petiolate, 8–17 cm long, bipinnate with a pair of opposite pinnae and the terminal pinna modified into a simple tendril, each pinna imparipinnate with 1–2 sets of opposite simple ultimate segments; petioles 2.5–3.0 cm long, inconspicuously sulcate, pilose; petiolules 3–7 mm long, inconspicuously sulcate, pilose; ultimate segments entire, 4–9 × 1.5–4.5 cm, elliptic to ovate, equilateral, plane, chartaceous, glabrate above except short-pilose along the midrib and proximal portions of the secondary veins, pilose beneath,

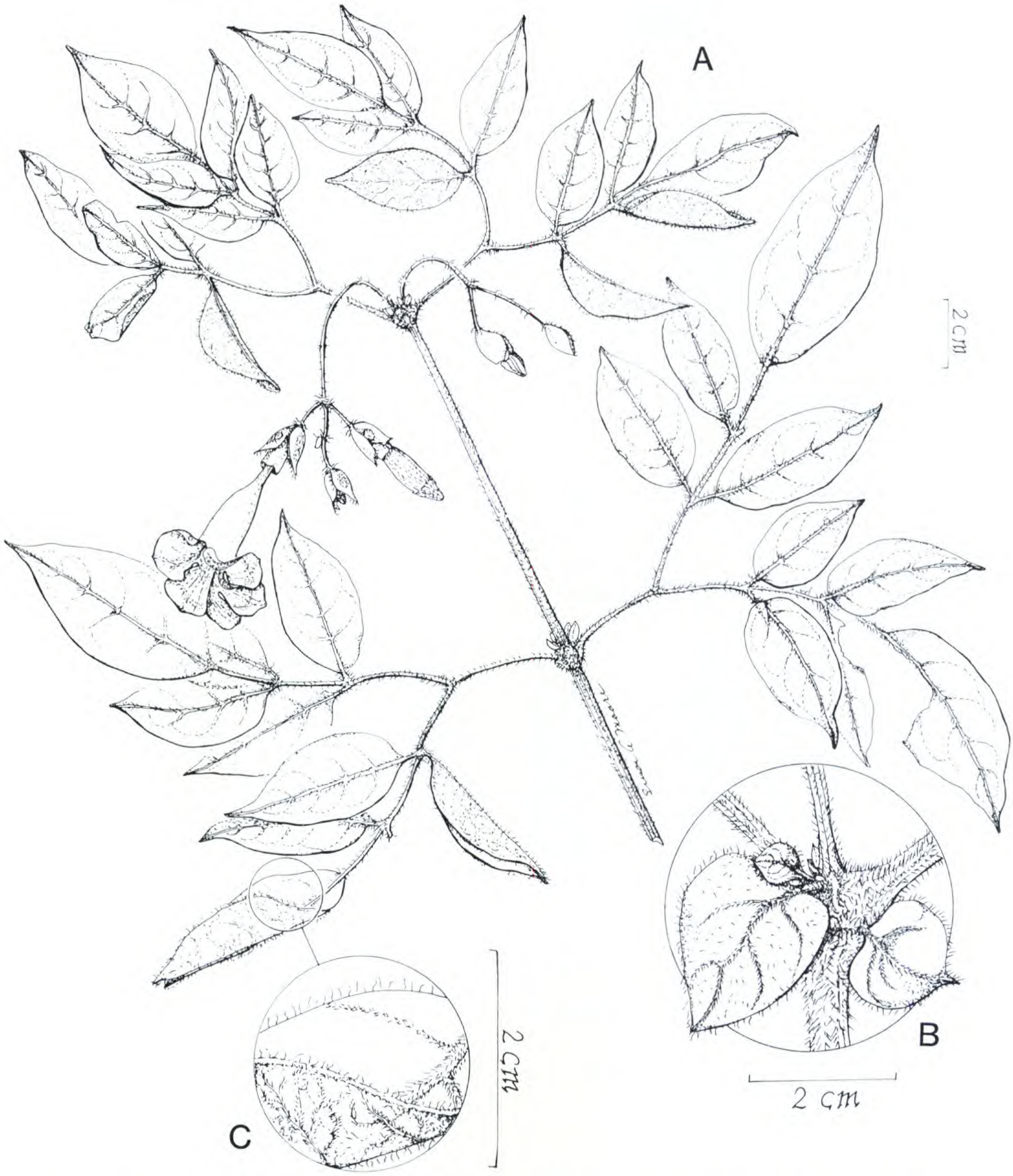

Figure 3. *Memora velutina* A. H. Gentry ex Hauk. —A. Leaves and inflorescences. —B. Pseudostipules. —C. Leaflet pubescence, adaxial and abaxial views. (From *Prance et al. P25891*, MO, NY, US.)

apically acute to slightly acuminate, basally obtuse to rounded, the venation brochidodromous with 4–6 principal vein pairs, marginally plane to slightly revolute; joints of the compound leaf conspicuously enlarged. *Inflorescences* elongate, axillary racemes to 10 cm long, unbranched, few- to several-flowered; rachis and peduncles terete, pilose, and bracteate, the bracts linear-triangular, 0.5–1.0 × 0.5 mm, caducous, eglandular, pilose; pedicels 2–4 mm long, glabrate to sparsely pilose; bracteoles ovate-elliptic and cupular, 10–13 × 5–7 mm, persistent, glandular, glabrate to sparsely pilose with pilose margins, extending beyond the tip of the calyx. *Flowers* ovoid in bud; calyx campanulate, 10–12 × 5–6 mm, eglandular, ecostate, the outer and inner calyx surfaces glabrate, the margin intact and flared, apically truncate except for 5 minute teeth; corolla zygomorphic, tubular-funnelform, yellow,

exserted 35–40 mm beyond the level of the calyx lip (45 mm total length), 2–3 mm wide at the calyx mouth, with an inner ring of pilose pubescence 7–10 mm beyond the corolla tube base; corolla lobes 5 (2 upper and 3 lower), 15 × 12–15 mm, short-orbicular, the inner and outer surfaces glandular-lepidote, no glandular fields present at the base of each lobe; fertile stamens didynamous, ca. 15 or 20 mm long, inserted near the level of the calyx tip, the single staminode inserted near the level of the fertile stamens; fertile anthers with two spreading thecae, glabrous, included; disc 1 mm tall; ovary 4–5 mm long, cylindrical, lepidote; style ca. 25 mm long; stigma bipartite and included. *Fruit* unknown.

Distribution. The type and only known collection was made on a roadside along the Transamazonian highway, 188 km west of Altamira. No information is available on elevation or habitat.

Phenology. The type collection was in flower in November. No collections of fruit are known at this time.

Memora velutina (Fig. 3) has several unique or unusual characters, the most conspicuous of which is its pilose pubescence. The density of trichomes seen in *M. velutina* is unusual in *Memora*, and the pilose pubescence is unlike the pubescence found on other *Memora* species. The combination of a campanulate calyx and bracteoles exceeding the calyx is found only in *M. velutina* and *M. longilinea* A. Sampiao, but the species are not similar otherwise. *Memora mollis* and *M. racemosa* have campanulate calyces, but both have small bracteoles. *Memora velutina* is also distinctive because of its few-flowered, somewhat delicate inflorescences. The large, foliaceous, cordate-orbicular pseudostipules contrast with the elliptic leaflet shape. The only other *Memora* species with pseudostipules of this shape is *M. adenophora* Sandwith. Affinities to existing *Memora* species are not clear, but probably lie with *M. racemosa*, *M. longilinea*, and *M. mollis*. Investigations of fruit and seed type, wood anatomy, and pollen morphology are needed to further assess the taxonomic affinities of this species.

Acknowledgments. I thank the Missouri Botanical Garden and Peter Raven for making Al Gentry's collections and databases available. Loans of material from the curators of US and NY are gratefully acknowledged. I thank William G. D'Arcy and Roy Gereau for assistance with the Latin descriptions, Rosa Ortiz-Gentry for helpful comments on the Spanish text, Kerry Barringer for general comments on the text, and José L. Fernández-Alonso and Porter P. Lowry for information pertaining to type specimens. Susan A. Moore provided the illustrations. This work was supported by the National Science Foundation (grant DEB-9509270).

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New Species of *Xylopia* and *Uvaria* (Annonaceae) from Tanzania

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ABSTRACT. Two new species of Annonaceae from the threatened lowland coastal forests of Tanzania are described and illustrated. *Xylopia mwasumbii* D. M. Johnson has distinctive flattened monocarps, unique among its African congeners. *Uvaria puguensis* D. M. Johnson is a small-flowered species belonging to a complex including, in East Africa, *U. angolensis*, *U. lucida*, and *U. tanzaniae*. A key to the taxa of the *U. angolensis* group in East Africa is provided.

Annonaceae are especially diverse in the lowland coastal forests of Tanzania and Kenya, with six genera and 35 species endemic to these forests (Verdcourt, 1971, 1986; Verdcourt & Mwasumbi, 1988; Vollesen, 1980). At the same time that the biological diversity of these coastal forests is being recognized, this rare forest formation is disappearing due to pressure from land development and charcoal production (Burgess et al., 1992; Mwasumbi et al., 1994).

Pugu Forest Reserve near Dar es Salaam, Tanzania, is the best-studied coastal forest in Tanzania (Burgess et al., 1992), yet we have just recently gathered sufficient material to describe two new species of Annonaceae, one in *Xylopia* and one in *Uvaria*, from this small reserve and nearby areas. Both species occur in forested uplands with a distinctive suite of associated species, including *Baphia puguensis* Brummitt, *Hugonia castaneifolia* Engler, *Hymenaea verrucosa* Gaertner, *Hymenocardia ulmoides* Oliver, *Landolphia kirkii* Dyer, *Lasiodiscus holtzii* Engler, *Manilkara sulcata* (Engler) Dubard, *Monanthotaxis fornicata* (Baillon) Verdcourt, *Nesogordonia holtzii* (Engler) Capuron, *Scorodophloeus fischeri* (Taubert) J. Leon, *Suregada zanzibariensis* Baillon, and *Uvaria pandensis* Verdcourt, as well as species of *Croton*, *Haplocoelopsis*, *Ochna*, *Megalochlamys*, *Rinorea*, and *Tessmannia*.

Verdcourt (1971), in his treatment of *Xylopia* for the *Flora of Tropical East Africa*, first drew attention to the specimen *Semsei 3704* from the Pugu Forest Reserve, identifying it as *Xylopia* "Species B" and commenting, "The material is scarcely adequate for description and only one of the two specimens seen bears flowers; both bear globose artichoke-like galls covered with conical tubercles which appear to be derived from the flowers." The name *Xylopia* "Species B" has, in the meantime, crept into East African floristic literature (e.g., Hawthorne, 1993), but it is now possible to name and describe this species in detail.

Xylopia mwasumbii D. M. Johnson, sp. nov. TYPE: Tanzania. Coast Region: Kisarawe District, Pugu Forest Reserve, along N road 0.5 km E of brick factory, 6°52′S, 39°06′E, 200 m, 16 Feb. 1996, *Johnson & Ndangalasi 1884* (holotype, OWU; isotypes, DSM, K, MO). Figure 1A–H.

Inter africanas *Xylopiae* species petalis lanceolatis olivaceis, staminibus non-capitatis, staminodiis nullis, carpellis duobus vel tribus, stigmatibus glabris oblongo-falcatis, toro leviter tantum concavo, et monocarpiis foliiformibus falcatis venosis compressis distincta.

Tree 4–9 m tall, DBH up to 8 cm, often with multiple trunks, the principal trunk often arching rather than erect; bark white with gray and orange mottling, exfoliating in places; slash brown on yellow (*ex* Hawthorne). Nodes occasionally with two or more axillary branches. Twigs 0.7–2.1 mm diam., gray, longitudinally wrinkled, with epidermis soon exfoliating, sparsely lenticellate, sparsely appressed-pubescent to glabrate, the simple hairs 0.2–0.4 mm long. Lamina of larger leaves 4.6–7.7 cm long, 2.4–4.3 cm wide, paler abaxially, subcoriaceous, broadly elliptic to elliptic, occasionally ovate, elliptic-ovate, or obovate-elliptic; base cuneate, decurrent on petiole; apex 4–8 mm long, blunt-acuminate, or occasionally obtuse and emarginate; lamina with adaxial surface glabrous, abaxial surface sparsely sericeous; midrib impressed to plane adaxially, abaxially raised and keeled; secondary veins 9–11 per side, departing at 50–60° from the midrib, weakly brochidodromous, anastomosing 1–2 mm from margin; secondary and high-

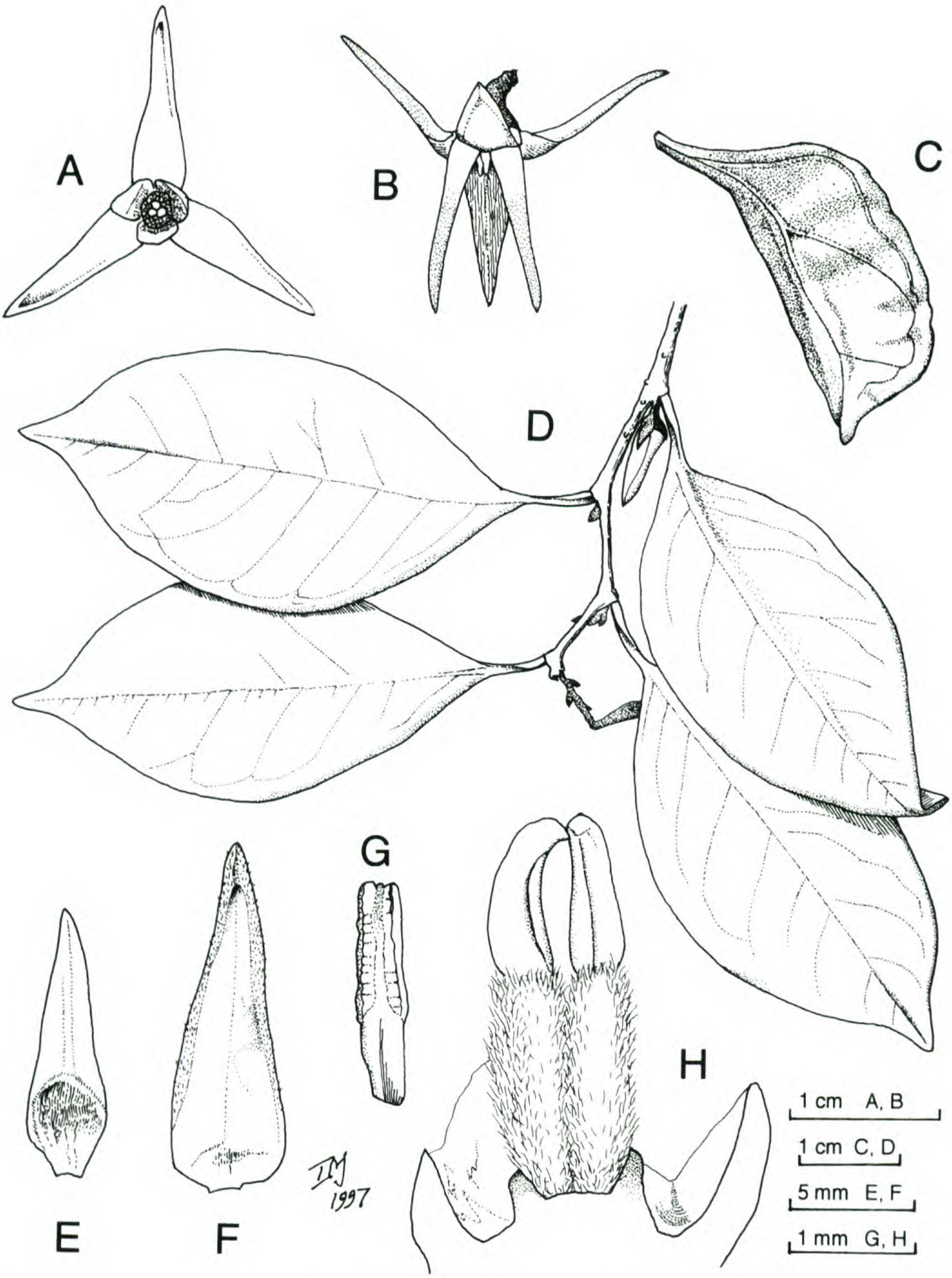

Figure 1. *Xylopia mwasumbii*. —A. Flower at anthesis, face view. —B. Flower at anthesis, lateral view. —C. Monocarp, lateral view. —D. Habit, with flower bud. —E. Inner petal, adaxial view. —F. Outer petal, adaxial view. —G. Stamen, abaxial view. —H. Longitudinal section of flower, with petals and stamens removed, showing two carpels seated in concavity of torus. C, D from *Johnson & Ndangalasi 1884* (OWU); A–B, E–H from *Johnson 1928A* (OWU). Note: A–C and E–H were drawn from fluid-preserved material and their dimensions are consequently ca. 20% greater than those given in the species description.

er-order veins indistinct, raised adaxially, slightly raised abaxially. Petiole 4.5–8 mm long, 0.9–1.2 mm wide, semiterete, flattened to canaliculate adaxially, glabrous to sparsely appressed-pubescent. Inflorescences of 1–3 flowers, the pedicels arising either from the axils of leaves or from the axils of bracts on a common peduncle 3–4 mm long; pedicels articulate at base, 2.5–4.6 mm long, 0.8–0.9 mm thick, bibracteate, sparsely pubescent to glabrate; bracts 0.8–1.1 mm long, quadrate, semicircular, or deltate, occasionally tearing down the center as the inflorescence enlarges. Buds linear-lanceolate, apex obtuse. Calyx 1.4–2.2 mm long, 2.5–3.3 mm diam., cup-shaped, coriaceous, sparsely sericeous abaxially; lobes 0.6–1.5 mm long, 1.5–2.2 mm wide, broadly triangular, obtuse to acute at apex. Corolla olive-yellow *in vivo*, coriaceous to slightly fleshy; outer petals spreading at anthesis, 8–10 mm long, 2–3 mm wide, linear-lanceolate to narrowly triangular, acute at apex, cuneate at base, appressed-pubescent adaxially, sericeous abaxially; inner petals erect at anthesis, 5.7–7.5 mm long, 1.8–2.2 mm wide, linear-lanceolate, basal ⅓ concave adaxially, keeled abaxially, glabrous except for a few hairs along abaxial keel. Stamens pale orange-yellow *in vivo*, ca. 40, 1.5–1.8 mm long, narrowly oblong, glabrous; anthers septate at anthesis; apex of connective rudimentary, not exceeding anther thecae, coriaceous to fleshy; filament ca. 0.7 mm long; staminodes absent. Carpels 2–3; ovaries 1.5–1.6 mm long, narrowly oblong, sericeous; ovules 4 in a single row; stigmas white *in vivo*, 0.7–1.1 mm long, lanceolate-falcate, acute, longitudinally grooved ventrally, glabrous. Torus 1.5 mm diam., elevated above the calyx with a shallow central concavity in which the ovaries are seated, glabrous. Fruit of 1–3 monocarps borne on a pedicel 4.5–6 mm long, 1.1–1.4 mm thick, sparsely pubescent to glabrate, with bracts and sepals persistent; torus of fruit ca. 2 mm diam.; monocarps near maturity yellow-green with green stipe and venation *in vivo*, probably dehiscent, 2–2.7 cm long, 1.1 cm wide, oblong, compressed laterally, venation of pericarp raised and distinct, finely verrucose, sparsely pubescent to glabrate; stipe 5–6.5 mm long, 1.5–1.6 mm wide; apex truncate, with an oblique mucro 1.7–2 mm long; wall ca. 0.5 mm thick. Seeds 2–4, at 60–90° to long axis of monocarp, 9 mm long, 6 mm wide, ellipsoid, elliptic in cross section, smooth; micropyle circular, flat, 2.2–2.4 mm diam.; aril cupular and forming a complete ring around micropyle, 5 mm diam., 2.2 mm deep, white, fleshy, readily detached from seed.

Distribution and phenology. Known only from dry evergreen forest on several small ridgetops and plateaus near the coast of east-central Tanzania, at elevations of 0–300 m. Specimens with flowers have been collected from February through May, and those with fruits from February through June. No definable peak of flowering was observed, but rather a few flowers at anthesis were present at any one time on a given tree. Similarly, only a very few fruits could be found on an individual tree at any one time. Vegetative growth seems to have been stimulated by the short rains of November–December, with production of flower buds following shortly thereafter.

Vernacular names and uses. *Mgwaza, mgwaza dume* (Zaramo). Used locally for tool handles and building poles.

I am pleased to name this distinctive species for my co-author, Leonard Mwasumbi, authority on the flora of Tanzania and herbarium superintendent at the University of Dar es Salaam, who taught me much about the flora of East Africa and guided me to localities for this species.

In Verdcourt's (1971) key to East African species of *Xylopia*, *X. mwasumbii* will key to *Xylopia odoratissima*, a species of the dry interior with pronounced pubescence on twigs, leaves, pedicels, and fruits, longer and more narrow petals, and monocarps that are irregularly oblong and not compressed. *Xylopia mwasumbii* does not, however, closely resemble this or any other East African species of *Xylopia*, with its subcoriaceous elliptic leaves, olive-yellow flowers, absence of prolonged anther connectives, lack of staminodes, small number of carpels, and flattened monocarps. It is sympatric with two other species of *Xylopia*, *X. parviflora* (A. Richard) Bentham and *X. arenaria* Engler. The former differs in being a large tree, the flowers of which have linear petals that flare into a saccate base. *Xylopia arenaria* is a small tree, more similar in habit, but its flowers are pale orange-yellow and the leaves are rounded at the base and chartaceous. Petal orientation at anthesis is distinctive in each of the three species: in *X. mwasumbii* the inner petals are erect and the outer petals are widespreading, in *X. parviflora* all six petals curve outward from the base and then inward at the apices, and in *X. arenaria* both series of petals are also erect, but the apex of each squarrose inner petal emerges through a gap between two outer petals.

The dry evergreen coastal forests where *X. mwasumbii* grows are both poorly known and very limited in extent. Within this rare forest formation the species may be commoner than is currently recognized: its green-tinted flowers and fruits are inconspicuous, and its principal flowering and fruiting occur during the long wet season. Also, it has a strong resemblance to species of *Diospyros* and,

in herbarium material, to other Annonaceae genera such as *Sphaerocoryne* and may thus be misidentified in collections. The flower-galls described by Verdcourt seem to be a frequent feature of the trees, and similar galls are found in other African species of *Xylopia* as well.

Paratypes. TANZANIA. **Coast Region:** Pande, *Hawthorne 1360* (K), *Hawthorne 1714* (K, *fide* B. Verdcourt); Pande, W edge, *Hawthorne 1469* (K); Kisiju, by the sea, *Hawthorne 1790* (DSM); Kisarawe District, Pugu Forest Reserve, ridges along N road between Pugu railway station and brick works, 6°52′30″S, 39°06′E, *Johnson & Mwasumbi 1899* (DSM, OWU); Kisarawe District, Pugu Forest Reserve, along N road 0.5 km E of brick factory, 6°52′S, 39°06′E, *Johnson 1920* (DSM, OWU), *Johnson 1928A* (OWU, spirit collection only); Kisarawe District, Pugu Forest Reserve, ridgetop over road tunnel, 6°52′30″S, 39°05′30″E, *Johnson & Mwasumbi 1936* (DSM, OWU); Kisarawe District, Pugu Forest Reserve, S of Dar–Kisarawe road, ridgetop near Mwakanga railway station, 6°55′S, 39°06′E, *Johnson & Ndangalasi 1948* (DSM, OWU); Bagamoyo District, Zaraninge Forest Reserve, 54 km E of Hwy., 6°04–13′S, 38°35–42′E, *Johnson & Mbago 1963* (DSM, OWU); Kisarawe District, Pugu Forest Reserve, bus roundabout area ca. 4 km E of Kisarawe, 06°53′30″ S, 39°06′E, *Johnson 1964B* (DSM, OWU); Kisarawe District, Kazimzumbwi Ruvu South [sic], *Magogo 618* (NHT, TFD); Kisarawe District, Banda Forest Reserve near Mfyoza village, *Ruffo 301* (EA, K, NHT, TFD); Kisarawe District, Pugu Forest Reserve, *Semsei 3704* (EA, K, TFD); Kisarawe District, Banda Forest Reserve, *Shabani 471* (EA, K, TFD); Pande Forest Reserve, 25 km WNW of Dar [es Salaam], *Wingfield 3311* (DSM, EA, K).

Uvaria L. is the largest genus of Annonaceae in the tropical East African flora, and many of its species groups are taxonomically difficult. Still, it is clear that there are undescribed species among the taxa represented. One of these came to the notice of L. Mwasumbi in the course of collaborative work with the research group studying Annonaceae secondary compounds in the Dept. of Chemistry at the University of Dar es Salaam under the leadership of M. H. H. Nkunya. Almost all of the collections of this species come from the Pugu Forest Reserve, where the plant is fairly common in the same habitats in which *Xylopia mwasumbii* occurs, but the plant has also been reported from the Pande and Kiono Forest Reserves as "*Uvaria* sp. nov." (Burgess et al., 1992; Mwasumbi et al., 1994).

Uvaria puguensis D. M. Johnson, sp. nov. TYPE: Tanzania. Coast Region: Kisarawe District, Pugu Forest Reserve, ridge trail from N road, 6°52′S, 39°06′E, 200 m, 24 Apr. 1996, *Johnson 1928* (holotype, OWU; isotypes, DSM, MO). Figures 2A, C–E, G, I, J.

Uvariae lucidae affinis, sed lamina basi distincte subcordata, pedicellis 3–5 mm longis, calyce 3–4 mm longo, petalis ovatis, 5–6 mm longis, flavo-viridibus vel pallide aurantiaco-flavis, staminibus 2.2–2.7 mm longis diversa.

Woody liana climbing to 6 m. Twigs 0.9–2 mm diam., longitudinally wrinkled, gray to black, at first ferruginous-pubescent, the stellate hairs 0.1–0.6 mm diam. with the tips of the stellae erect or appressed, at length glabrate. Lamina of larger leaves 8.8–12.4 cm long, 4.3–6.6 cm wide, shiny and gray-green adaxially, dull and greenish yellow abaxially, subcoriaceous, elliptic, obovate, or oblanceolate; base distinctly subcordate, occasionally rounded; apex 6–10 mm long, acuminate; expanded lamina with adaxial surface glabrous except for a few hairs on the midrib, abaxial surface with scattered stellate hairs; midrib impressed adaxially, raised abaxially; secondary veins 9–11 per side, departing at 50–70° from the midrib, weakly brochidodromous, slightly impressed adaxially, slightly raised abaxially; higher-order veins indistinct on both surfaces. Petiole 6–10 mm long, 1.5–2 mm wide, terete, pubescent. Inflorescences internodal, usually closer to the distal nodes, 1–2-flowered. Inflorescence axis 3–5 mm long, 1.3–1.8 mm thick, covered by yellowish rusty stellate pubescence, with two clasping bracts ca. 2 mm long; buds globose. Calyx connate, tearing longitudinally as flower opens, 3–4 mm long, 5 mm diam., cup-shaped, coriaceous, pubescent abaxially. Corolla slightly fleshy; petals light green *in vivo* and erect in pistillate phase of anthesis, yellow-green to pale orange-yellow *in vivo* and strongly recurved in staminate phase; inner and outer petals subequal, 5–6 mm long, 3.6–4 mm wide, ovate, glabrous and somewhat verrucose adaxially, pubescent abaxially and on margins. Stamens mustard-yellow at anthesis *in vivo*, 30–40, 2.2–2.7 mm long, narrowly oblong, glabrous except for the puberulous connective apex, which is 0.3–0.5 mm long and quadrate to ovate; anthers latrorse; filament short or lacking. Carpels 6–8; ovaries 3.4–4.1 mm long, oblong, longitudinally sulcate on ventral surface, pubescent; ovules 8–9 in a single row; stigmas 0.7–0.8 mm long, obconic to quadrate, pubescent on sides. Torus 3 mm diam., flat, umbonate in center, with a few scattered hairs. Fruit of 5–8 monocarps borne on a pedicel 5 mm long, 1.9 mm thick, covered with dense appressed yellowish gray stellate pubescence; bracts persistent; torus of fruit 3 mm diam.; monocarps (immature) 1.7 cm long, 0.7–0.8 cm wide, oblong, slightly constricted between the seeds, subsessile, pubescent; apex rounded, with a small beak 1.2 mm long; wall ca. 0.5 mm thick. Seeds 1–4, at 90° to long axis of monocarp.

Distribution and phenology. Known from ridgetops and slopes in several areas of dry evergreen

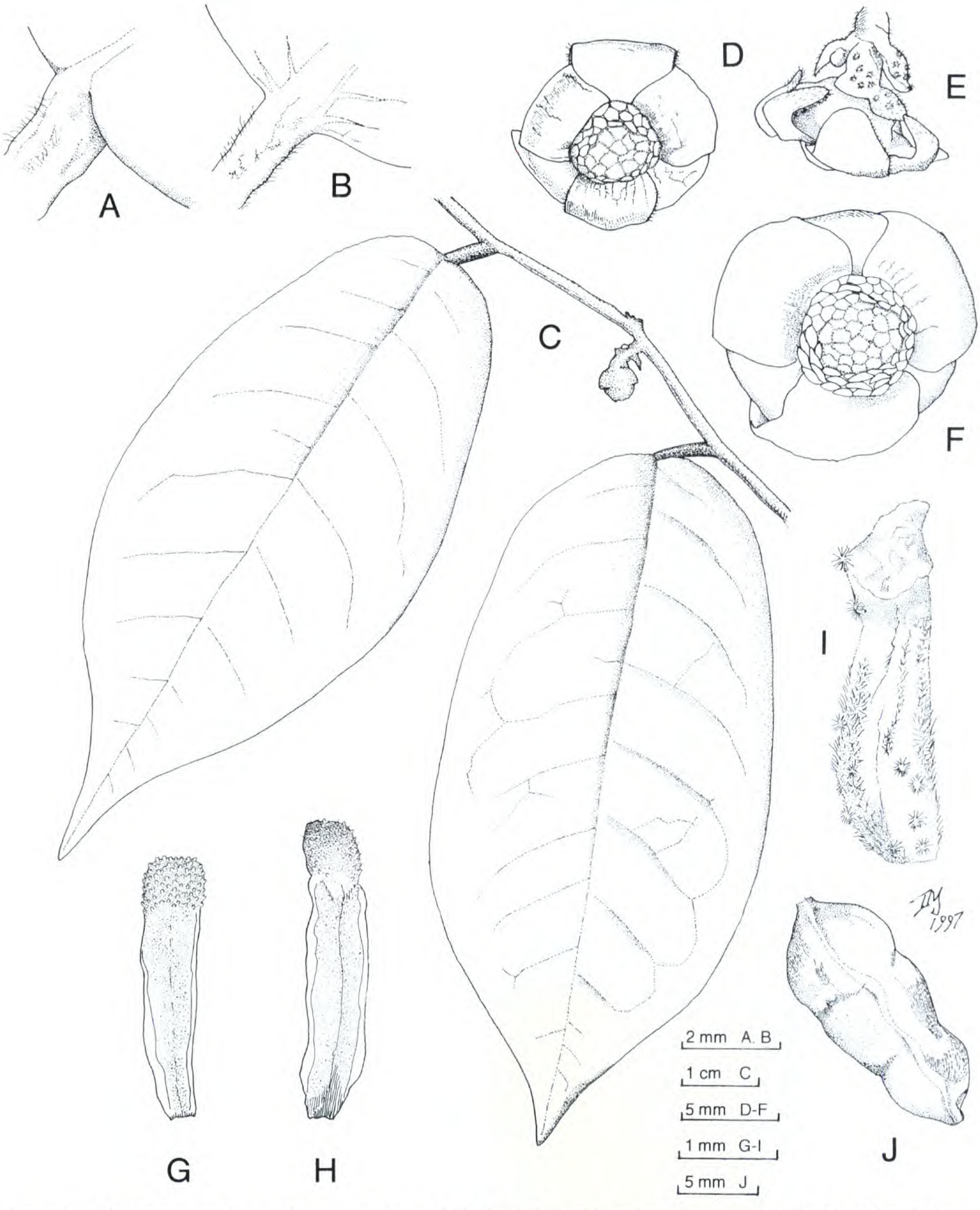

Figure 2. *Uvaria puguensis* and *Uvaria lucida*. A, C–E, G, I–J: *Uvaria puguensis*. —A. Detail of leaf lamina base. —C. Habit with flower bud. —D. Flower in staminate phase of anthesis, face view. —E. Flower in staminate phase of anthesis, lateral view. —G. Stamen, abaxial view. —I. Carpel. —J. Monocarp, lateral view. B, F, H: *Uvaria lucida*. —B. Detail of leaf lamina base. —F. Flower in staminate phase of anthesis, face view. —H. Stamen, abaxial view. D & E from *Johnson & Ndangalasi 1949* (OWU), A, C, G, I, & J from *Johnson 1928* (OWU), B, F, & H all from *Johnson & Murray 1887* (OWU). Note: D–F and G–I were drawn from fluid-preserved material and their dimensions are consequently ca. 20% greater than those given in the species description.

coastal forest in east-central Tanzania, at elevations up to 300 m, where it has been found in flower from February through June, and fruiting in April.

Uvaria puguensis belongs to a group of species that includes, in East Africa, *U. angolensis*, *U. lucida*, and *U. tanzaniae*. The group is characterized by connate sepals, which form a cup that is torn open by the developing corolla, and by petals that become completely revolute during anthesis. Distinctions among these taxa are presented in the key below. The only one of these species known to be sympatric with *U. puguensis* is *U. lucida*.

KEY TO THE EAST AFRICAN TAXA OF THE *UVARIA ANGOLENSIS* GROUP (ADAPTED FROM VERDCOURT, 1971, 1986; THE ALPHANUMERIC CODES FOLLOWING EACH SPECIES NAME REFER TO THE FLORA OF TROPICAL EAST AFRICA FLORISTIC DIVISIONS, AS CITED IN VERDCOURT, 1971)

1a. Petals 12–25 mm long, uniformly tomentose on both surfaces; carpels/monocarps typically 20–35.
  2a. Leaf bases distinctly cordate; leaf strongly hirsute beneath . . . . . *U. tanzaniae* Verdcourt (T3, T6)
  2b. Leaf bases broadly cuneate, rounded, or slightly cordate; leaf sparsely pubescent beneath . . . . . *U. angolensis* Oliver (U1–4; T1, 4, 7; Sierra Leone to Cameroon, Congo, Sudan, Zambia, Angola)

1b. Petals 5–13 mm long, glabrous or with hairs sparse toward the apex adaxially, pubescent abaxially; carpels/monocarps 5–20.
  3a. Leaf base cuneate or rounded (Fig. 2B), rarely subcordate; inflorescence axis 5–10 mm long; petals 7–13(–20) mm long, green or grayish brown, oblong-ovate or rounded-obovate; stamens 2.5–4 mm long . . . . . *U. lucida* Bentham
    4a. Leaves mostly relatively broad, obtuse to shortly acuminate at the apex, drying pale green; indumentum of calyx and monocarps mostly pale brown or orange-brown; calyx, petals, stamens, and monocarps with dimensions toward the lower of the limits given . . . . . *U. lucida* Bentham subsp. *lucida* (K4, 7; T3, 6, 8; Z;? P)
    4b. Leaves relatively narrower, obtuse to acuminate (acuminate in East African material), drying a darker green; indumentum of calyx and monocarps mostly dark brown; calyx, petals, stamens, and monocarps with dimensions toward the upper of the limits given . . . . . *U. lucida* Bentham subsp. *virens* (N. E. Brown) Verdcourt (T6, Malawi, Mozambique, Zimbabwe, South Africa)
  3b. Leaf base distinctly subcordate; inflorescence axis 3–5 mm long; petals 5–6 mm long, yellow-green to pale orange-yellow, ovate; stamens 2.2–2.7 mm long . . . . . *U. puguensis* D. M. Johnson (T6)

This species is a locally common component of the forest flora in the Pugu Hills, more common there than its close relative *U. lucida*. In our experience, the flower buds frequently showed insect feeding damage, so that few flowers reached anthesis; fruits were consequently scarce.

Paratypes. TANZANIA. **Coast Region:** Kisarawe District, Pugu Forest Reserve, ridges along N road between Pugu Railway Station and brick works, 6°52′30″S, 39°06′30″E, *Johnson & Mwasumbi 1898* (DSM, OWU); Kisarawe District, Pugu Forest Reserve, along N road between Pugu railway station and brick works, 6°52′30″S, 39°06′E, *Johnson 1916* (DSM, OWU); Kisarawe District, Pugu Forest Reserve, S of Dar–Kisarawe road, ridgetop near Mwakanga railway station, 6°55′S, 39°06′E, *Johnson & Ndangalasi 1949* (DSM, OWU); Pande Forest Reserve, *Mwasumbi 14705* (DSM); Pugu Forest Reserve, *Mwasumbi 12532* (DSM).

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Calathea singularis and *Stromanthe palustris*, Two New Species of Neotropical Marantaceae

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ABSTRACT. *Calathea singularis* from southeastern Brazil and *Stromanthe palustris* from Costa Rica are described as new. *Calathea singularis*, vegetatively unique within the Marantaceae, has a pulvinus of two separate parts rather than the pulvinar cells continuous and encircling the uppermost portion of the petiole. *Stromanthe palustris*, endemic to the Atlantic lowlands of Costa Rica, is described for inclusion in *A Manual to the Plants of Costa Rica* treatment.

Calathea singularis H. Kennedy, sp. nov. TYPE: Brazil. Espírito Santo: Munic. de São Mateus, Reserva Biologica de Sooretama, Lagoa do Macucu, umbrofila crescendo em local úmido, ca. 40 m, 16 Mar. 1972, *D. Sucre 8698* (holotype, RB 157123; isotypes, K, RB). Figure 1.

Species pulvino haud integro autem bi-partito a congeneribus et insupra confamiliis diversa.

Rosulate, shortly caulescent herb, 30–70 cm high, bearing 4–15 leaves, 3–6 basal and 1 cauline on main shoot, lateral shoots develop in axils of basal leaves bearing (0)1–3 leaves at the base and 1(–3) cauline. Plants deciduous, dying back to the rhizome during the dry season; the roots bearing terminal, tuber-like swellings. Leaves homotropic. Leaf blade lightly pleated, herbaceous, elliptic to broadly elliptic, apex rounded with short acumen, base rounded to obtuse; 23–47 × 13–29 cm. Leaf blade above with stomates present, grass-green, glabrous, midrib likewise; leaf surface below glaucous silvery green or faintly tinged purple, glabrous, midrib pale green, V-shaped, glabrous. Pulvinar region narrowly triangular in cross section, pulvinar cells present only in a small area between the base of the blade and the sheath and as a narrow band on the very back shortly extending along the midrib, green with pulvinar cells brownish, glabrous, region between blade and sheath 0.2–0.4 cm, total length of area of pulvinar cells 0.9–1.7 cm, depth 0.3–0.5 cm. Petiole lacking. Leaf sheath auriculate, the central portion triangular in cross section, the sides broadly spreading above to strongly reflexed at base, herbaceous, light green, often reddish purple at very base of subtending leaf, 14–23 cm long in subtending leaf, others 23–34 cm long. Stem green, internode below subtending leaf 6–20 cm long. Inflorescence terminal on main shoot, imbricate, ovoid, apex acute (in side view), 8–14 × 3.5–5 cm, additional inflorescences terminating the shoots produced in the axils of the basal leaves. Peduncle green, occasionally tinged pink at apex, minutely pilose (14×), 3.5–7(–9) cm long. Bracts 36–44, spirally arranged, herbaceous, lowermost bract reniform, obtuse with short acumen, bract shape changing from depressed ovate to depressed elliptic in lower bracts to broadly obovate in upper ones, apex obtuse to 90°, occasionally with slight acumen, 3.1–4.2 × 3.5–5.8 cm, bracts 10 and higher less than 4.3 cm wide; each bract subtends 2–4 flower pairs. Outer surface of bracts green, whitish at base in upper ones, glabrous; inner surface lighter green, glabrous. Bicarinate prophyll membranaceous, broadly ovate, obtuse, translucent faint green to transparent, glabrous, 1.8–2.2 × 1.4–2.1 cm, 0.7–1 cm wide, carina to carina. Secondary bract membranaceous, ovate, acute, translucent faint green, glabrous, 1.5–1.8 × 0.8–1 cm. Bracteoles 1 per flower pair, membranous medial, carinate, transparent, glabrous, 0.3–0.9 × 0.2–0.3 cm long, occasionally reduced or absent in first flower pair. Sepals membranaceous, ovate-elliptic, obtuse, translucent white, glabrous, 5–6 × 3.5–4 mm. Corolla 43–47 mm long, tube cream above, white below, glabrous, 27–30 × 2.5 mm with slit to 10 mm long; corolla lobes subequal, narrowly elliptic to oblong, obtuse to acute, pale cream-yellow, glabrous, 12–16 × 4–7 mm. Outer staminode broadly obovate to elliptic, emarginate, pale cream-yellow, 11–15 × 12–13 mm. Callose staminode oblong, apex acute, the apical 2 mm petaloid, the rest callose, pale cream-yellow, 9–10 × ca. 4 mm. Cucullate staminode pale cream-yellow, ca. 6 × 4 mm. Stamen with lateral petaloid appendage to 1.5 mm wide. Style and stigma cream, the back of the style turns brown after tripping. Ovary smooth, pink, glabrous, ca. 2 × 2 mm. Capsule unknown.

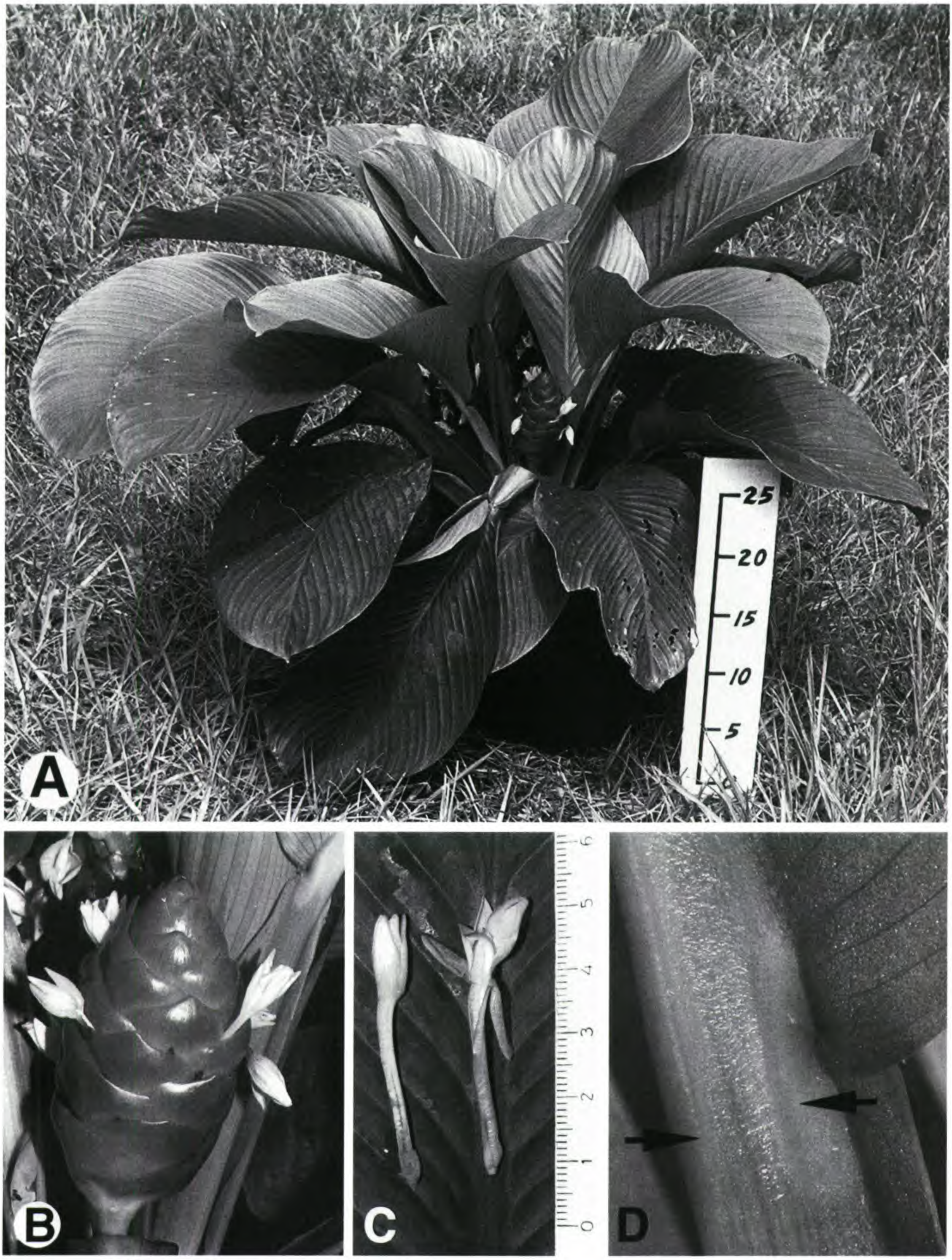

Figure 1. *Calathea singularis* H. Kennedy. —A. Habit. —B. Inflorescence. —C. Flowers on upper leaf surface. —D. Pulvinar region. Arrows indicate the two separate regions of pulvinar cells.

Calathea singularis belongs to *Calathea* sect. *Breviscapus* Bentham, by virtue of its several basal leaves, the inflorescence borne on the leafy shoot, and spirally arranged bracts. It is distinguished from all other species of Marantaceae by the unique pulvinus structure of two distinct regions of pulvinar cells rather than a single continuous cylindric band of pulvinar cells surrounding the uppermost

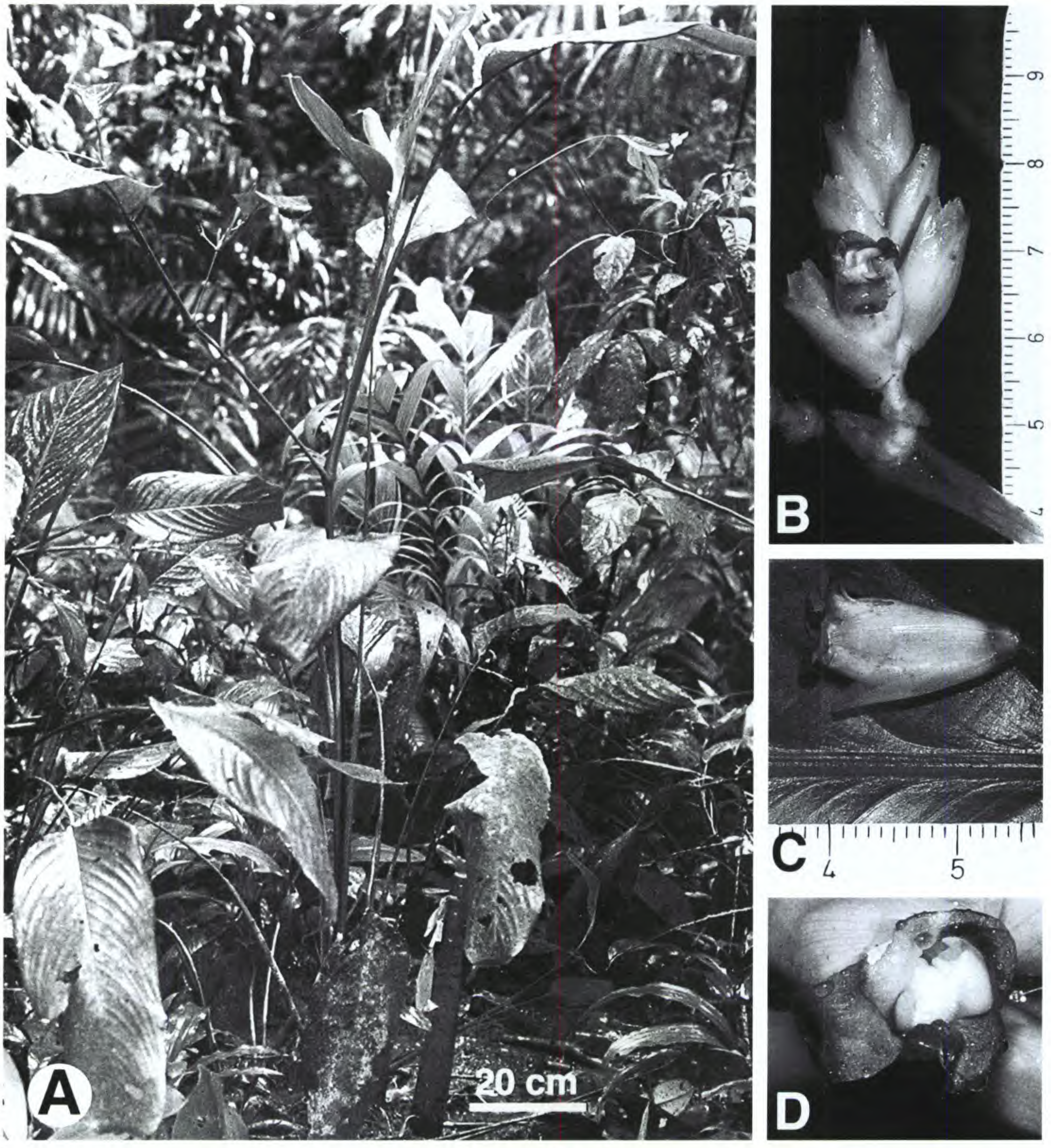

Figure 2. *Stromanthe palustris* H. Kennedy. —A. Habit. —B. Inflorescence. —C. Flower on upper leaf surface. —D. Flower, face view.

portion of the petiole. It is most closely related to *Calathea albo-vaginata* (K. Koch) K. Schumann, sharing the deciduous habit, reflexed sheath margins, and lack of a proper petiole. *Calathea singularis* differs from *C. albo-vaginata* in the green vs. white margin of the leaf sheath and the bracts erect, not reflexed at the apex.

Paratypes. BRAZIL. **Espírito Santo:** Munic. Linhares, Reserva Florestal da Cia. Vale do Rio Doce, Est. Gávea, ant. X-2, km 20,100, erva à beira da estrada, *D. A. Folli 1026* (CVRD). Cultivated. Jardim Botânico do Rio de Janeiro, 1954, *G. Barroso s.n.* (RB 88428); Jardim Botânico do Rio de Janeiro, without collector or date (RB 97116).

Stromanthe palustris H. Kennedy, sp. nov. TYPE: Costa Rica. Heredia: Finca La Selva, the OTS Field Station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, along Loop Trail on S side of Quebrada El Salto, ca. 6 m from trail, ca. 100 m, Aug. 1978, *B. Kirchoff 6578* (holotype, CR; isotype, DUKE). Figure 2.

Aliis speciebus Americae centralis combinatione florum purpureorum, bractearum viridium et foliorum basalium praesentium bene distincta.

Caulescent, branched herb, 1.3–2.1 m high, bearing 3–5 basal leaves and 2–3 cauline on main stem, additional shoots often produced in the axils of the cauline leaves. Cataphylls stiff, coriaceous, narrowly ovate, apiculate, dark green tinged with purple; tomentose to subvillous basally, the hairs borne on a raised, wart-like, cushion of cells lacking purple pigmentation; up to 53 cm long. Leaves antitropic. Leaf blade herbaceous, ovate-oblong, apex rounded with eccentric acumen, base unequal, obtuse, often very shortly, abruptly, attenuate; 15–19 × 7–10.5 cm in subtending leaf, 26–62 × 11–20 cm in others. Leaf blade above shiny dark green, glabrous, midrib dark olive-green, pilose along each side at junction with blade; leaf surface below light green, glabrous except pilose along margin at apex, midrib olive-green, occasionally tinged with purple, pilose along sides, more densely so at the base. Pulvinus broadly elliptic in cross section, dark olive-green, tomentose along the front, the rest glabrous, articulate, ca. 2× wider than petiole, 0.9–4.8 cm long. Petiole dark green, tomentose to villous toward base, somewhat roughened with minute irregular warts, bearing a slight groove, (0)20–77 cm long, usually absent in uppermost cauline leaves. Leaf sheath with stiff, papery margins, not auriculate, deep green, lighter at margin, roughened, villous, hairs golden brown to 3 mm long; sheath of uppermost leaf 5–7 cm long, others 15–80 cm long. Base of leaf sheath swollen, whitish yellow. Stem green, slightly roughened, subvillous, hairs falling in age, the internode between the basal leaves and lowermost cauline leaf, 60–110 cm long. Inflorescences terminal and lateral, several per shoot, imbricate initially, spreading with age, ovate, laterally compressed, 5–8.7 × 2.5–3.3 cm. Peduncle light green to yellow-green, sparsely pilose, 1.5–13 cm long, longer in the axial inflorescences than the terminal ones. Bracts deciduous, distichous, 8–19 (generally only 6–12 present at any one time during the main flowering period) dorsiventrally oriented, conduplicately folded, very broadly elliptic to subround, apex rounded, occasionally with a very short acumen, 1.4–2.1 × 1.1–1.7 cm. Bracts herbaceous, chartreuse, glabrous except for a tuft of hairs at apex; inner surface shiny light green, each subtending up to 2 or more flower pairs. Bicarinate prophyll membranaceous, elliptic, apex obtuse, translucent light chartreuse, carina sparsely pilose at apex, the rest glabrous, ca. 0.7 × 1 cm. Sepals herbaceous, obovate to elliptic, obtuse, translucent chartreuse, glabrous, 13.5–16 × 5–6 mm. Corolla tube white, glabrous, ca. 3 mm long; corolla lobes subequal, elliptic, obtuse, white, pilose at apex, 7–8 × 4–5 mm. Outer staminodes oblong, rounded with minute acumen, basal ⅔ white, deflexed apical ⅓ purple, ca. 5 mm wide. Callose staminode petaloid apically, rounded, reddish purple at apex, white basally, ca. 9 × 6.5 mm. Cucullate staminode white, ca. 5 mm long. Anther light brown, 2 mm long. Style and stigma white. Ovary white, densely sericeous, hairs golden brown to 2 mm long, 2.5 × 2 mm. Capsule unknown.

Stromanthe palustris and *S. tonckat* (Aublet) Eichler are the only species of *Stromanthe* in Central America with purple flowers. *Stromanthe palustris* is readily distinguished from *S. tonckat* by the several basal and cauline leaves vs. strictly cauline leaves, the densely villous vs. sparsely appressed pilose leaf sheaths (hairs obvious to the naked eye vs. hairs only visible with lens or microscope), and the longer pulvinus (0.9–4.5 cm vs. 0.15–0.5 cm). *Stromanthe hjalmarssonii* (Körnicke) O. G. Petersen from Nicaragua, which has basal leaves and villous leaf sheaths, has cream-colored flowers and only one or two cauline leaves and does not have the additional leafy shoots in the axils of the lower cauline leaves found in *S. palustris*. The specific epithet, *palustris*, refers to the habitat of the species, growing in mucky, somewhat swampy, soil.

The description given under *Ctenanthe sp. nov.* in Hammel's (1986: 240) publication of Marantaceae for La Selva is of *Stromanthe palustris*. "*Ctenanthe sp. nov.*" referred to the populations on the Osa Peninsula that had purple bracts and distinctly villous leaf sheaths and petioles. These populations are now recognized as merely one end of the (clinal) variation within *Ctenanthe dasycarpa* (Donnell-Smith) K. Schumann, not a distinct species. *Ctenanthe dasycarpa* has basal leaves and may also have villous sheaths, but has persistent rather than deciduous bracts.

Ctenanthe and *Stromanthe* are closely related, both having antitropic leaves. While the majority of species are easily classified as belonging to one or the other of these genera, a few are problematic having some characters found in both. Although the longer sepal length (13 mm) is characteristic of *Ctenanthe*, I feel the aspect of deciduous rather than persistent bracts is more significant for its placement in *Stromanthe*. Unfortunately, the seed and capsule, which might have provided additional characters, were not found in any of the specimens examined.

Paratypes. COSTA RICA. **Heredia:** Finca La Selva,

the OTS Field Station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, along Quebrada El Saltito, back of Loop Trail, 900 m E, ca. 100 m, 29 Aug. 1980, *B. Hammel 9627* (DUKE). **Limón:** Hitoy Cerere Reserve and vicinity in Valle La Estrella S of Finca Concepción, Los Jabillos, near station, 140 m, 09°42′N, 83°02′W, 2 Aug. 1985, *B. Hammel & M. Grayum 14352* (CR); Hitoy Cerere Reserve and vicinity in Valle La Estrella, 09°40′00″N, 83°02′05″W, 28 Oct. 1990, *B. Hammel et al. 17948* (CR).

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Trois Espèces Nouvelles d'Oleaceae et Note sur la Présence d'*Olea capensis* dans l'Archipel des Comores

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RÉSUMÉ. L'étude des caractères morphologiques permet la description de trois espèces nouvelles d'Oleaceae de l'Archipel des Comores: *Noronhia cochleata* Labat, M. Pignal & O. Pascal, *Chionanthus cordifolius* Labat, M. Pignal & O. Pascal et *C. insularis* Labat, M. Pignal & O. Pascal. Les oliviers sauvages de l'Archipel sont pour la première fois rattachés à *Olea capensis* L. s.l.

ABSTRACT. Morphological characters support the description of three new species of Oleaceae from the Comoro Archipelago: *Noronhia cochleata* Labat, M. Pignal & O. Pascal, *Chionanthus cordifolius* Labat, M. Pignal & O. Pascal, and *C. insularis* Labat, M. Pignal & O. Pascal. For the first time the Archipelago "Wild Olive Tree" is identified as *Olea capensis* L. s.l.

Les inventaires floristiques récents des plantes indigènes ou naturalisées de Mayotte menés par le Service de l'Environnement et de la Forêt en collaboration avec le Muséum national d'Histoire naturelle de Paris ont permis d'approfondir la connaissance de cette flore insulaire. Les récoltes systématiques réalisées lors de ce projet ont notablement enrichi les collections herbariologiques peu abondantes et souvent anciennes. L'étude de ce nouveau matériel et la révision des spécimens de l'Archipel des Comores présents dans l'herbier du Muséum (P) ont permis d'identifier plusieurs taxons nouveaux. Une espèce de Sapotaceae a déjà été décrite (Labat et al., 1997). Pour la famille des Oleaceae, ce travail révèle l'existence de trois espèces nouvelles. Il conduit également dans cette région à clarifier la position systématique des populations appartenant au genre *Olea*.

Note. L'herbier cité "MAYOTTE" ne possède pas d'acronyme officiel; il s'agit de l'herbier du Service de l'Environnement et de la Forêt de Mayotte.

Noronhia cochleata Labat, M. Pignal & O. Pascal, sp. nov. TYPE: Mayotte. Mlima Combani, 28 déc. 1995 (fl), *O. Pascal 281* (holotype, P(P75025); isotypes, K, MAYOTTE, MO, P(P75026, P75027)). Figure 1.

A *Noronhia boivinii* Dubard, domatiis conspicuis, inflorescentiis majoribus compositisque, fructibus ellipsoideis apiculatisque, differt.

Petit arbre jusqu'à 7 m de hauteur et atteignant rarement 10 cm de DBH, ou grand arbuste, écorce des petits rameaux grisâtre parfois très clair, portant des lenticelles blanchâtres ou homochromes avec le reste des rameaux, glabre. Feuilles opposées, vertes dessus, glauques dessous, limbe oblong-elliptique, 7.5–13.5 × 2–5 cm, non coriace, glabre, présentant sur la face inférieure à l'aisselle de la plupart des nervures secondaires des domaties cratériformes velues bien visibles à l'oeil nu, ponctuations brun clair présentes, mais souvent non visibles, même à la loupe, nervation brochidodrome, nervure primaire déprimée dessus, saillante et généralement brun rougeâtre dessous, 7 à 10 paires de nervures secondaires alternant avec une nervure inter-secondaire et se divisant avant d'atteindre l'arc reliant les nervures secondaires, nervures inter-secondaires et tertiaires habituellement plus visibles à la face supérieure de la feuille, seules les nervures secondaires sont bien marquées à la face inférieure, sommet longuement cuspidé,

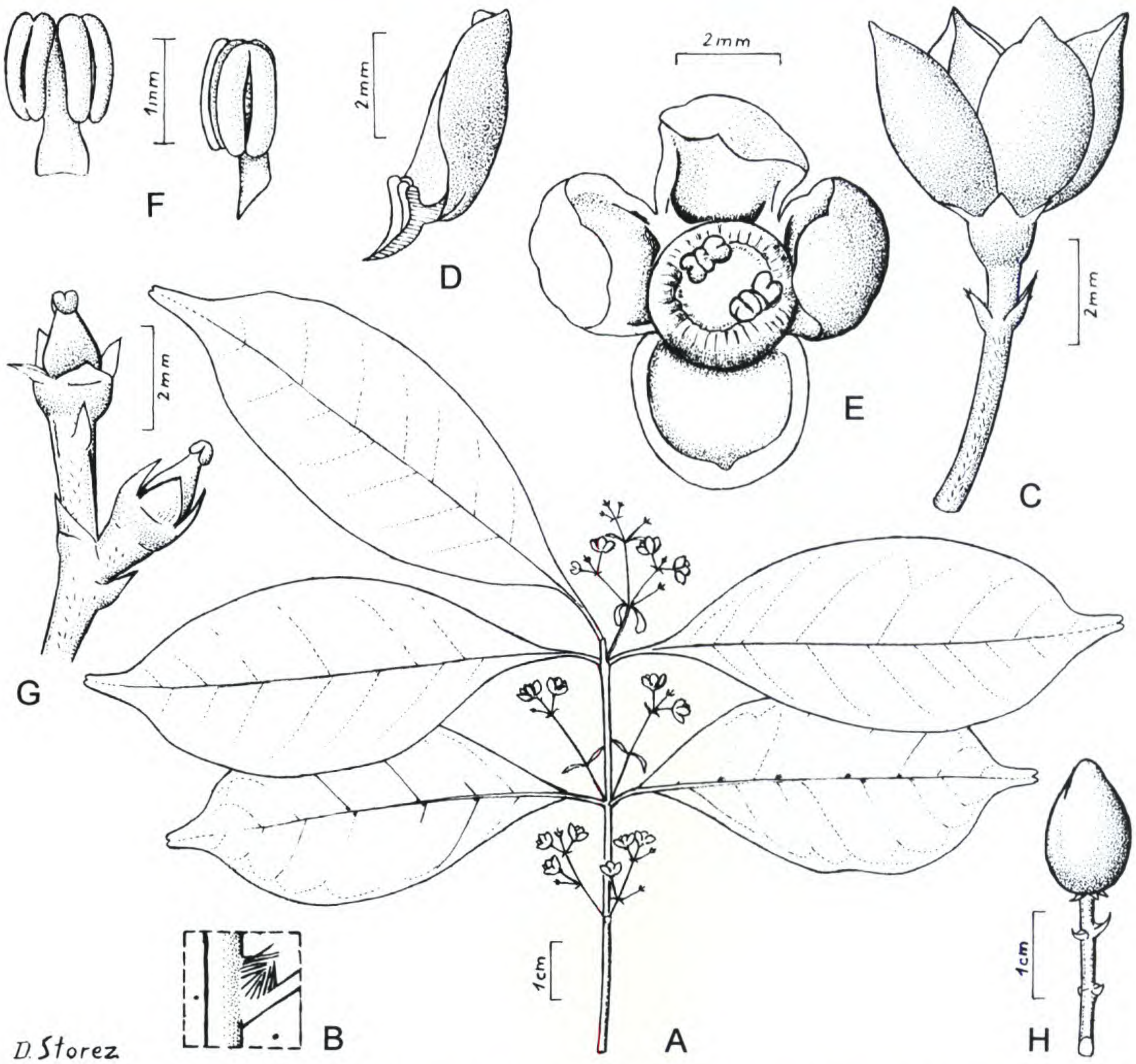

Figure 1. *Noronhia cochleata* Labat, M. Pignal & O. Pascal. —A. Aspect général. —B. Détail de la face inférieure de la feuille avec domatie. —C. Fleur vue de profil. —D. Lobe de la corolle. —E. Corolle et étamines vue de dessus. —F. Etamine. —G. Ovaires en place. —H. Fruit. (A dessiné d'après *Pascal 857*, B–F d'après *Pascal 281*, et G d'après *Pascal 418*.)

cuspide longue de 0.5–1.7 cm à sommet arrondi et émarginé, parfois à peine distinctement, marge très légèrement et irrégulièrement sinueuse et crispée, légèrement repliée sur la face inférieure, base aiguë, atténuée sur le pétiole; pétiole épais, rougeâtre et lisse à l'état jeune devenant grisâtre et fissuré par la suite, canaliculé à la face supérieure, de 6–8 mm de longueur et de ca. 1.5 mm de diamètre, glabre. Inflorescence axillaire en cymes triflores ou en pléiochazes longues de 1.5–2.5 cm environ, pubescentes; pédoncule non renflé long de 1–8 mm; ramifications vertes à noirâtres sur le sec, grêles, longues de 3–8 mm; pédicelle de la fleur terminale de 2 mm ou parfois sub-sessile, jusqu'à 4 mm de longueur pour les fleurs latérales; bractées oblongues triangulaires, longues de 1–3 mm, pubescentes; bractéoles triangulaires de 0.8–1 mm de longueur et 0.5 mm de largeur, sub-glabres, mais terminées par une petite touffe de poils blancs longue de 0.12 mm au maximum. Fleurs petites; calice gamosépale à tube court, 4 lobes triangulaires verts de 1 × 1 mm, glabres et surmontés des mêmes petits poils blancs; corolle gamopétale, blanche devenant jaune puis orange en vieillissant, 4 lobes sub-orbiculaires, cochléaires, de 3.5 mm de largeur et 3 mm de hauteur, soudés sur 1/3 inférieur, tube de la corolle très court de 0.5 mm environ, coronule très petite, formant un bourrelet circulaire de 0.6 mm de hauteur et 0.5 mm de largeur; androcée à 2 étamines soudées au tube de la corolle par leur filet, filet 0.4 mm de hauteur et 0.3 mm de largeur, anthères introrses, basifixes, grossièrement rectangulaires, 1 mm de hauteur, 0.8 mm de largeur et 0.5 mm d'épaisseur, pubescentes ex-

térieurement, déhiscentes par 2 fentes latérales; gynécée supère, ovaire biloculaire, pluriovulé, 0.6–0.8 mm de longueur et 0.6 mm de largeur; style conique de 0.5 mm de long et 0.4 mm de large à la base, surmonté par 2 stigmates tuberculeux et papilleux de 0.3 mm. Infrutescence grisâtre, calice persistant. Fruits immatures en drupes ellipsoïdes, 1.5 × 1 cm, apiculées.

Noronhia cochleata appartient au groupe *Genuinae* défini par Perrier de la Bâthie (1952); elle diffère de *N. boivinii* Dubard, espèce allopatrique des forêts orientales malgaches, par la présence de domaties, ses inflorescences plus longues et composées, ses fruits ellipsoïdes et apiculés. *N. cochleata* et *N. comorensis* S. Moore présentent une distribution sympatrique, mais cette dernière espèce en diffère principalement par des fleurs fasciculées et des corolles campanulées à lobes réduits à de larges ondulations arrondies. Un spécimen, *Jacquemin 860-J*, Ile de Mohéli, piste du Badjo au sommet du M'Ze, Koukoule, 12 nov. 1970 (P), paraît très proche de ce taxon, mais les fleurs presque entièrement détruites par des insectes ne permettent pas une identification certaine.

Distribution. Endémique de l'île de Mayotte.

Ecologie. Petit arbre de sous-bois, relativement commun dans les massifs forestiers humides de l'île, absent des vestiges de forêts sèches (zones pour lesquelles la saison sèche est supérieure à 6 mois).

Phénologie. Sempervirent, floraison de novembre à janvier, fructification en mars–avril.

Nom vernaculaire. Saritsileytri (en chibuchi, dialecte malgache de Mayotte).

Paratypes. MAYOTTE. Majimbini, 6 nov. 1995 (fl), *Pascal 150* (MAYOTTE, P); Mlima Choungui, 16 nov. 1995 (fl), *Pascal 205* (G, K, MAYOTTE, MO, P, WAG); Sohoa, 30 nov. 1995 (fl), *Pascal 257* (K, MAYOTTE, MO, P); Sohoa, 14 mars 1996 (fr), *Pascal 418* (K, MAYOTTE, MO, P); Dapani, 7 jan. 1997 (fl) *Pascal 857* (K, MAYOTTE, MO, P, WAG).

Chionanthus cordifolius Labat, M. Pignal & O. Pascal, sp. nov. TYPE: Mayotte. Mlima Choungui, 29 déc. 1995 (fl), *O. Pascal 288* (holotype, P(P75021); isotypes, K, MAYOTTE). Figure 2.

A *Chionantho mildbraedii* (Gilg & Schellenberg) Stearn, foliis parvioribus, ovatis, domatiis absentibus, inflorescentiis brevioribus, differt.

Petit arbre de 6 m de hauteur, écorce des rameaux brun grisâtre foncé, glabre, avec quelques lenticelles homochromes avec le reste des rameaux. Feuilles opposées, face supérieure brune, presque luisante, face inférieure vert brunâtre, limbe ové à plus rarement oblong-ové, (4–)6.5–10 × (1.4–)3–4.3 cm, légèrement coriace, glabre, sans domaties à l'aisselle des nervures secondaires, densément couvert de ponctuations brun clair à noires, seulement visibles à la loupe, nervation brochidodrome, nervure primaire déprimée dessus, saillante et généralement brun rougeâtre dessous, 6 à 8 paires de nervures secondaires alternant avec une nervure inter-secondaire se divisant avant d'atteindre l'arc reliant les nervures secondaires, apex obtus à aigu, parfois courtement acuminé, base tronquée, légèrement cordée; pétiole épais, présentant la même couleur et texture que les rameaux, souvent légèrement coudé, de 3–4 mm de longueur et de 1.5–2 mm de diamètre, glabre. Inflorescences en pléiochazes lâches, axillaires, de 3 cm environ, glabres, à pédoncule grisâtre, de 3–7 mm de longueur et à ramifications noires sur le sec, grêles, de 7–15 mm de longueur; pédicelles floraux identiques aux ramifications, mais plus courts, (0–)2 × 5 mm; bractées de 1 mm environ, jamais foliacées, pubescentes; bractéoles identiques aux bractées, mais deux fois plus petites, insérées à 1.5–2 mm en dessous du calice. Calice gamosépale, 4 lobes verts triangulaires à extrémité arrondie, de 1 mm de hauteur et 1–2 mm de largeur, soudés sur leur tiers inférieur, formant une collerette étalée, même dans les fleurs en boutons; corolle à 4 lobes jaunes, épais, ovés, de 4 mm de longueur et 3 mm de largeur, soudés à la base, pas de coronule; androcée à 2 étamines soudées à la corolle, subsessiles, anthères cordiformes très épaisses de 2 mm de largeur et 0.8–1 mm d'épaisseur, basifixes, introrses à déhiscence par des fentes presque latérales; gynécée supère, pyriforme, de 1.2 mm de hauteur en incluant le style, et 1 mm de large à la base, ovaire composé de 2 loges à 2 ovules, style peu distinct de l'ovaire, 2 stigmates. [Fruit inconnu.]

Chionanthus cordifolius est proche de *C. mildbraedii*, mais ses feuilles, plus petites, sans domaties, sont ovées et très larges dans le tiers inférieur avec une base tronquée et légèrement cordée sur un pétiole court et trapu donnant un aspect presque sessile à la feuille. Cet aspect est caractéristique de cette espèce nouvelle, par rapport à toutes les autres espèces africaines et malgaches connues. Les inflorescences sont également lâches, mais beaucoup plus courtes que chez *C. mildbraedii*.

Distribution. Endémique de l'Ile de Mayotte.

Ecologie. Petit arbre de sous-bois rare, uniquement rencontré vers 500 m d'altitude en forêt humide. Cette espèce semble affectionner les crêtes dans la zone des brouillards matinaux. Apparemment absent des vestiges de forêts sèches.

Phénologie. Sempervirent, floraison connue uniquement en décembre.

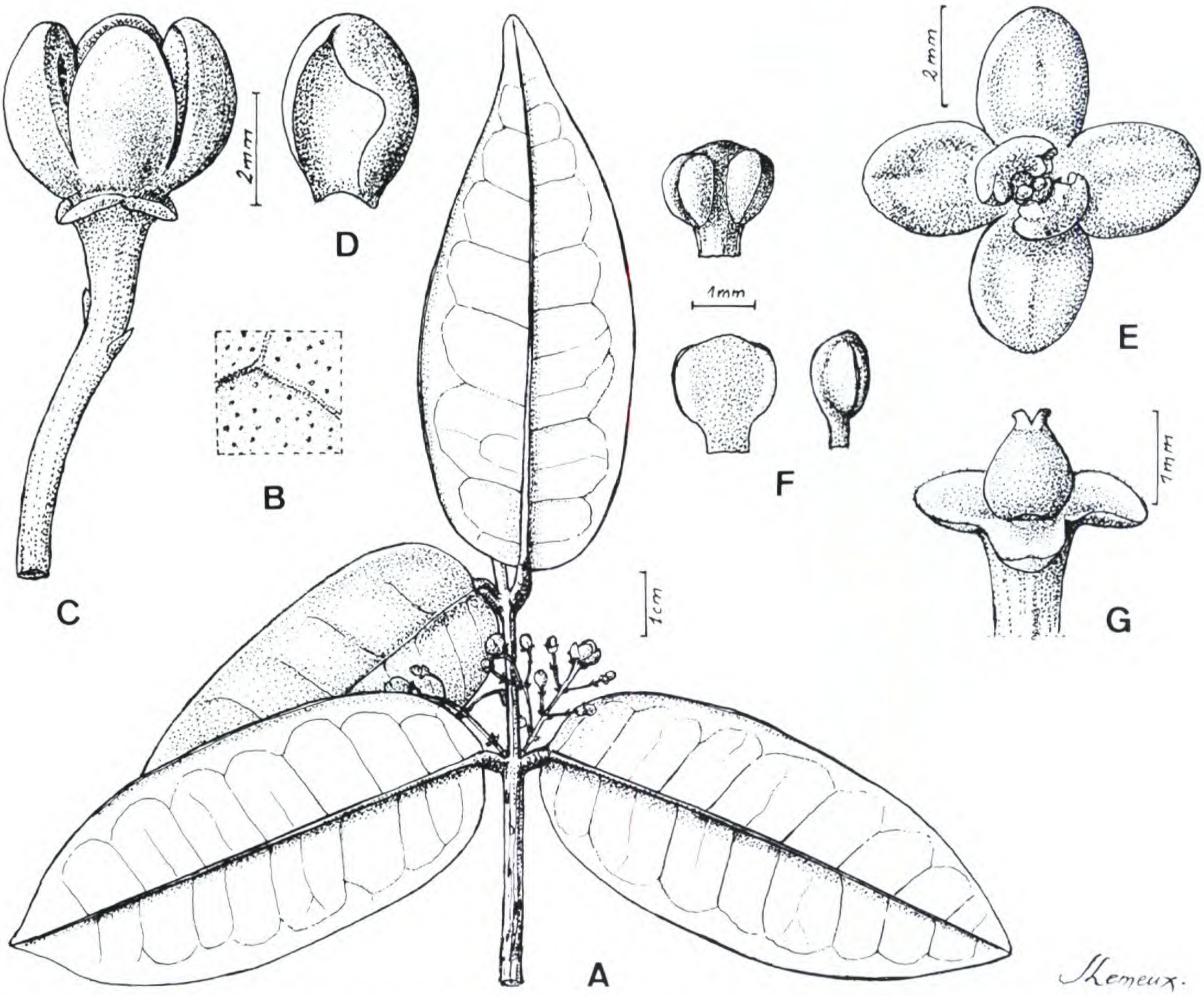

Figure 2. *Chionanthus cordifolius* Labat, M. Pignal & O. Pascal. —A. Aspect général. —B. Détail de la face inférieure de la feuille. —C. Fleur vue de profil. —D. Lobe de la corolle. —E. Corolle et étamines vue de dessus. —F. Etamine. —G. Ovaire. (A–G dessiné d'après *Pascal 288.*)

Chionanthus insularis Labat, M. Pignal & O. Pascal, sp. nov. TYPE: Mayotte. Bénara, 350 m, 11 oct. 1996 (fl), *O. Pascal 713* (holotype, P (P75020); isotypes, B, G, K, MA, MAYOTTE, MO, NY, P(P75017, P75018, P75019 alcool), WAG). Figure 3.

A *Chionantho cordifolio* Labat, M. Pignal & O. Pascal, foliis majoribus, oblongis ellipticis, basi haud cordata, inflorescentiis majoribus, staminibus apiculatis, differt.

Arbre de 15 m de hauteur (jusqu'à 30 m selon Humblot?) et de 40–45 cm de diamètre, écorce des rameaux grise, glabre, portant d'assez nombreuses lenticelles légèrement plus claires. Feuilles opposées, face supérieure vert brunâtre, face inférieure plus claire, limbe oblong-elliptique, (8–)11–20 × (3–)4–7 cm, peu coriace, glabre, domaties cratériformes, velues à subglabres, rarement absentes, en général 1–5 situées à l'aisselle de quelques nervures secondaires entre le quart et la moitié inférieur du limbe, rarement plus haut, densément couverte de ponctuations brun clair à noires, seulement visibles à la loupe, nervation brochidodrome, nervure primaire déprimée dessus, saillante et généralement brun rougeâtre dessous, 8 à 10 paires de nervures secondaires alternant avec une nervure inter-secondaire se divisant avant d'atteindre l'arc reliant les nervures secondaires, apex acuminé à cuspidé, cuspide longue de 1–1.5 cm, non échancrée à l'extrémité mais souvent nécrosée, base aiguë à atténuée; pétiole épais, présentant la même couleur et texture que les rameaux, souvent légèrement coudé, de 7–10 mm de longueur et de ca. 2 mm de diamètre, glabre. Inflorescences en pléiochazes axillaires lâches, pouvant parfois paraître terminales, jusqu'à 7.5 cm de longueur, glabrescentes, à pédoncule grisâtre, court, 2–6 mm de longueur et à ramifications noires sur le sec, longues de 15–35 mm; pédicelle souvent à section carrée, long de 3–8(–10) mm pour la fleur terminale et de 5–10(–14) mm pour les fleurs latérales; bractées parfois triangulaires et longues de 3 mm ou parfois

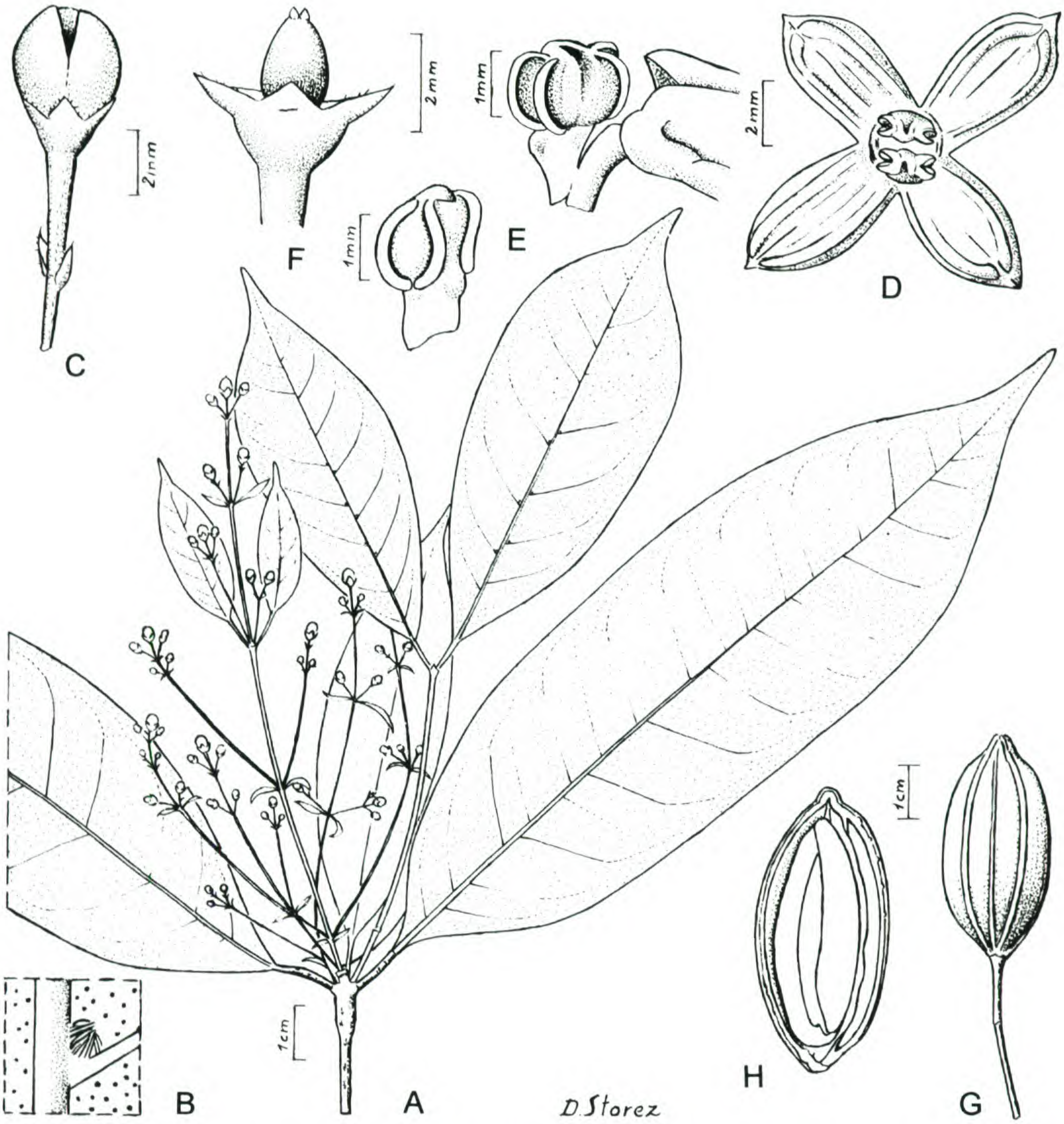

Figure 3. *Chionanthus insularis* Labat, M. Pignal & O. Pascal. —A. Aspect général. —B. Détail de la face inférieure de la feuille avec domatie. —C. Bouton floral. —D. Corolle et étamines vue de dessus. —E. Etamine et base de la corolle. —F. Ovaire. —G, H. Fruit. (A–F dessiné d'après *Pascal 713* et G–H d'après *Pascal 617*.)

foliacées et de 8–40 mm, acuminées; 2 bractéoles opposées, triangulaires, longues de 1 mm, ciliées. Calice gamosépale, 4 lobes verts de 2.3 mm de largeur et 1.5 mm de hauteur, soudés à leurs bases, ciliés; corolle gamopétale, rotacée, à 4 lobes jaune vif très épais, elliptiques-ovés, soudés à la base, 4.5 mm de longueur et 3 mm de largeur, extrémité intérieure sillonnée, pas de coronule; androcée à 2 étamines soudées à la corolle, opposées aux sépales, filet aplati de 0.8 mm de large et 1.2 mm de hauteur, anthères basifixes, sub-orbiculaires, ca. 1.6 mm de diamètre, introrses, à fentes latérales, connectif élargi en une courte pointe terminale; gynécée supère, ovaire pyriforme, large de 1 mm à la base, biloculaire, style peu distinct de l'ovaire, de 0.3 mm de hauteur, 2 stigmates. Infrutescences rigides, grisâtres, ne portant habituellement qu'un seul fruit développé. Fruits en drupe ellipsoïdale, 4.5 × 2 cm, à fines crêtes saillantes et présentant un rostre court au sommet.

Chionanthus insularis diffère de *C. cordifolius* par ses feuilles plus grandes, oblongues-elliptiques, non cordées à la base, ses inflorescences plus grandes et ses étamines apiculées. Cette nouvelle espèce est également assez proche par la structure des inflo-

rescences et la morphologie florale de *C. mildbraedii*, mais elle en diffère en particulier par ses étamines apiculées, ainsi que par la forme et la taille de ses fruits. Il existe une espèce, *Linociera mayottensis* H. Perrier (Perrier de la Bâthie, 1949, 1952), décrite sur un spécimen récolté sur l'île de Mayotte: *Boivin 3196*. Stearn (1980) a volontairement exclu cette espèce de sa révision des *Chionanthus* d'Afrique, considérant que sa position taxonomique était incertaine. En effet, le spécimen type est très incomplet et en mauvais état. Cependant, l'étude des caractères observables permet de considérer qu'il s'agit d'une espèce différente: les débris de fleurs présents ont montré que chez *L. mayottensis* l'étamine est plus allongée et que l'apicule est plus long et fin, de plus les inflorescences n'ont pas de pédoncule grisâtre différencié, sont pubescentes, plus courtes et plus compactes que chez *C. insularis*. Le spécimen fructifère, *Loup 71*, de *C. insularis*, récolté sur la Grande Comore, porte des fruits très immatures lisses, mais il est probable que les crêtes apparaissent plus tardivement. Elles sont effectivement présentes sur les fruits, légèrement plus développés, mais encore immatures du spécimen *Humblot 1407*.

Distribution. Endémique des îles de Mayotte et de la Grande Comore.

Ecologie. Espèce rare à Mayotte, connue par un seul individu rencontré vers 500 m d'altitude lors des inventaires réalisés par le Service de l'Environnement et de la Forêt de Mayotte. Sa présence dans la forêt de Nioumbadjou, dans la région occidentale de la Grande Comore, sensiblement plus humide (3 à 4 m d'eau par an) et possédant le seul climat axérique de l'île (sans saison sèche), peut expliquer en partie sa rareté à Mayotte où les conditions climatiques ne seraient pas favorables à son développement. Cependant, l'absence de données concernant son abondance et sa répartition à la Grande Comore, ou dans les autres îles de l'Archipel, ne permet pas de conclure sur les préférences écologiques de cette espèce.

Phénologie. Sempervirent, floraison observée en août et octobre et fructification en août et octobre–novembre.

Nom vernaculaire. N'driali mendje; N'drihali (Grande Comore).

Paratypes. MAYOTTE. Forêt de Combani, 13 nov. 1884 (jfr), *Humblot 1407* (P); Bénara, 1 août 1996 (fr), *Pascal 617* (G, K, MAYOTTE, MO, P). GRANDE COMORE. Nioumbadjou, 4 août 1952 (fl), *Service des Eaux et Forêts de Madagascar 5432-SF* (P); village de Nioumbadjou, chemin du capitaine Dubois en direction de N'Kourani, 9 oct. 1984 (jfr), *Loup 71* (P).

Sur la Présence d'*Olea capensis* L. aux Comores

Perrier de la Bâthie (1952), dans son traitement pour la flore de Madagascar et des Comores, avait examiné des récoltes provenant de Mayotte (*Boivin 3197*) et d'Anjouan (*Boivin s.n.*). Ce matériel n'avait été intégré dans la flore que sous la forme d'une note: "Boivin a récolté sur l'île de Mayotte (Comores), des spécimens (*Boivin 3197*), trop incomplets pour être décrits, mais appartenant très probablement au genre *Olea*." Perrier de la Bâthie ne rapproche pas non plus ces plantes des espèces africaines puisqu'il note sur le spécimen de Mayotte, qu'il s'agit d'une "espèce probablement nouvelle, mais trop pauvrement représentée (. . .)," et sur celui d'Anjouan, il mentionne qu'il s'agit sans doute de la même espèce. Les récoltes plus complètes que nous avons étudiées, en particulier celles de O. Pascal de Mayotte, ne nous permettent pas à notre tour de rattacher ces plantes aux espèces malgaches. La systématique des *Olea* de Madagascar doit être entièrement revue à la lumière de l'abondant matériel récolté, essentiellement par le Service Forestier de Madagascar, depuis le traitement de Perrier de la Bâthie. Cependant, l'espèce la plus affine est *O. madagascariensis* Boivin ex H. Perrier. Les spécimens des Comores s'en différencient principalement par leurs inflorescences plus grêles, leurs lobes du calice moins prononcés, leurs fruits plus larges et arrondis au sommet.

Par ailleurs, des caractères morphologiques, essentiellement la présence d'inflorescences terminales, les différencient très clairement d'*Olea europea* L. subsp. *africana* (Miller) P. S. Green et les rapprochent au contraire d'*Olea capensis* L. Coates Palgrave (1996) note chez *O. capensis* une écorce gris foncé, avec un rhytidome fissuré verticalement et la formation caractéristique d'un exsudat noir dans l'écorce entaillée. Ces caractères ont été observés pour les individus de Mayotte.

Olea capensis est une espèce africaine largement distribuée dans les forêts sempervirentes et semi-décidues d'Afrique tropicale, sa répartition s'étend jusqu'en Afrique du Sud. L'extrême variabilité de *O. capensis* a conduit Verdoorn (1956) à regrouper dans l'espèce deux autres taxons d'Afrique du Sud en définissant deux unités infra-spécifiques: *O. capensis* subsp. *enervis* (Harvey) I. Verdoorn et *O. capensis* subsp. *macrocarpa* (C. H. Wright) I. Verdoorn. En 1983, Kupicha souscrit à une définition encore plus large de l'espèce en mettant en synonymie de nombreuses espèces d'Afrique et en ne reconnaissant aucune sous-espèce. Par la suite, Friis et Green (1986), tout en admettant la complexité

de ce groupe, reviennent à la conception de Verdoorn pour l'Afrique du Sud et reconnaissent en plus deux sous-espèces pour l'Afrique tropicale (subsp. *hochstetteri* (Baker) Friis & P. S. Green et subsp. *welwitschii* (Knoblauch) Friis & P. S. Green).

Les caractères foliaires des spécimens des Comores sont intermédiaires entre ceux des deux sous-espèces d'Afrique tropicale, alors que le fruit, une drupe ovoïde de 1.5 × 1 cm, est proche de ceux observés chez la sous-espèce *macrocarpa* du Transvaal, Natal et Province du Cap. Les inflorescences sont plus lâches et grêles que dans les récoltes africaines en général. Il est donc difficile d'assimiler les plantes des Comores à l'une des sous-espèces existantes.

Les délimitations taxonomiques de ce groupe sont loin d'être claires. En reprenant à notre compte les propos de Friis et Green (1986): "There is no doubt that a full and careful analysis of *O. capensis sensu lat.* throughout its range is needed but unfortunately neither of us is in a position to undertake this at present. However, for practical purposes names are required, to enable reference to be made to the entities in north-east tropical Africa"; il nous semble inopportun de décrire un nouveau taxon infra-spécifique. De plus, *O. madagascariensis*, qui appartient également à ce complexe, devra être examinée au même titre que les populations continentales. En attendant une étude plus approfondie, nous considérons que les plantes examinées appartiennent à l'espèce *O. capensis sensu lato*, signalée ici pour la première fois dans l'archipel des Comores (Grande Comore, Mayotte, Anjouan, Mohéli).

Notes écologiques et physionomiques. A Mayotte, cette espèce est commune dans toutes les reliques de forêt naturelle humide de l'île, entre 150 m (limite inférieure des reliquats) et 600 m d'altitude. C'est un arbre massif, muni de contreforts puissants largement étalés, le tronc principal dépasse rarement 6–7 m de hauteur, 3 ou 4 branches maîtresses dressées prennent en général le relais et forment un houppier en entonnoir largement évasé au sommet. Cet allure peu forestière est habituellement plus caractéristique des milieux ouverts. Les grands sujets (jusqu'à 25 m de hauteur et 80 cm de diamètre) sont connus dans les massifs les plus humides (Bénara et M'Tsapéré) sur pente et haut de pente. Sur les crêtes de ces massifs, comme dans des zones moins arrosées (plateau de Sohoa et Ouchoungui sur la côte ouest, Mont Choungui au sud de l'Ile) leur port est plus rabougri et les individus rejettent abondamment à la base des souches. La période de floraison paraît relativement brève, au plus fort de la saison des pluies, de mi-janvier à fin février; la fructification s'étale de mars à septembre et jusqu'en novembre.

Noms vernaculaires. M'Rimeou, Mkarare (Grande Comore), Chivoumze, Sheivindze (Anjouan), Antsagniry (dialecte chibuchi), M'chélélé (dialecte chimahorais) (Mayotte).

Matériel étudié. GRANDE COMORE. Forêt de la Grille, 09 fév. 1957 (fl), *Service des Eaux et Forêts de Madagascar 16524 SF* (P); forêt du Karthala, Convalescence, route Capitaine Dubois, 19 fév. 1957 (fl), *Service des Eaux et Forêts de Madagascar 16598 SF* (P). MOHÉLI. Forêt Bambao, Fomboni, 16 mars 1957 (fr), *Service des Eaux et Forêts de Madagascar 16716 SF* (P). ANJOUAN. Sin. loc., mai 1850 (fr), *Boivin s.n.* (P(P80210)); Koni Djodjo, 1 nov. 1984 (fr), *Ducatillion 447* (P); Koni Djodjo, 1 nov. 1984 (fl), *Ducatillion 448* (P); face sud-est du mont Tingui, Dindi, Ouani, 12 mars 1957 (fl), *Service des Eaux et Forêts de Madagascar 16674 SF* (K, P). MAYOTTE. Au pied du Chongui, au dessus de Dapani, juil. 1848 (fr), *Boivin 3197* (P); Choungui, 6 sep. 1995 (fr), *Pascal 4* (MAYOTTE, P); Dapani, 17 jan. 1996 (fl), *Pascal 335* (B, BR, G, K, MA, MAYOTTE, MO, NY, P, PRE, WAG); Dapani, 23 jan. 1996, (fl), *Pascal 355* (K, MAYOTTE, P); Tchaourembo, 8 fév. 1996 (fr), *Pascal 384* (MAYOTTE, P); Sohoa, 14 mars 1996 (fr), *Pascal 419* (MAYOTTE, P); Dapani, 11 avr. 1996 (fr), *Pascal 459* (K, MAYOTTE, P); Sohoa, 25 sep. 1995 (fr), *Pascal et Ali andi 67* (MAYOTTE, P); forêt d'Ouchoungui, 25 mars 1957 (fl), *Service des Eaux et Forêts de Madagascar 16775 SF* (P); forêt d'Ouchoungui, 25 mars 1957 (fl, fr), *Service des Eaux et Forêts de Madagascar 16776 SF* (P).

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Nomenclatural Consequences of the Synonymization of *Hypsela reniformis* (Campanulaceae: Lobelioideae)

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ABSTRACT. The recent synonymization of *Hypsela reniformis* with *Pratia repens* has necessitated several nomenclatural changes. The enlarged circumscription of *P. repens* dictates the validation of a new combination to cover the species when it is considered a member of *Lobelia*. Because *H. reniformis* was the type of its genus, its three remaining congeners can no longer employ that generic name. They are transferred to *Isotoma*, from which they differ solely in the possession of indehiscent (vs. capsular) fruit.

Recently, Chiapella (1996) demonstrated statistically that two long-recognized South American species of Lobelioideae (Campanulaceae), *Hypsela reniformis* (Kunth) C. Presl (including *Pratia longiflora* J. D. Hooker) and *Pratia repens* Gaudichaud, could not be distinguished in any meaningful way, i.e., that the two names pertained to a single species. This conclusion has nomenclatural consequences that extend beyond South America and a simple taxonomic merger. The purpose of this paper is to effect changes necessitated by Chiapella's (1996) findings, in preparation for a forthcoming checklist of the species of Campanulaceae (cf. Lammers, 1995, 1998a).

GENERIC CONSIDERATIONS

Coincidentally, each species is the type of its respective genus. As a result, their merger into one species means that these two genera must likewise be merged. *Pratia* Gaudichaud, the name under which far more species have been described, has 11 years priority over *Hypsela* C. Presl, and was the name adopted by Chiapella (1996), as well as by Baillon (1885), who treated *Hypsela* as a section of *Pratia*.

However, there has been a growing trend over the past 40 years to not recognize *Pratia* as a distinct genus. The primary character used to distinguish it from *Lobelia* L. has been its indehiscent (vs. capsular) fruit (Bentham, 1876; McVaugh, 1943; Wimmer, 1943, 1953). However, various workers have called attention to intraspecific variation in fruit type (Moeliono & Tuyn, 1960), a lack of correlation between fruit type and other characters (Albrecht, 1994), and the greater overall resemblance of various species of *Pratia* to species of *Lobelia* than to congeners (Adams, 1972; Wilbur, 1991; Murata, 1995), and subsumed *Pratia* into *Lobelia*. As a result, *Hypsela* should also be regarded as a synonym of *Lobelia*, as indicated in the partial synonymy below:

Lobelia L., Sp. Pl. 929. 1753; Gen. Pl. (ed. 5) 401. 1754. TYPE: *Lobelia cardinalis* L. (lectotype, designated by Hitchcock & Green (1929: 184)).

Pratia Gaudichaud, Ann. Sci. Nat. 5: 103. 1825. *Lobelia* [no rank indicated] *Pratia* (Gaudichaud) Heynhold, Nom. Bot. Hort. 1: 473. 1840. *Lobelia* sect. *Pratia* (Gaudichaud) J. Murata, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 15: 356. 1995. TYPE: *Pratia repens* Gaudichaud.

Hypsela C. Presl, Prodr. Monogr. Lobel. 45. 1836. Syn. nov. *Lysipomia* sect. *Hypsela* (C. Presl) A. DC., in DC., Prodr. 7: 350. 1839. *Pratia* sect. *Hypsela* (C. Presl) Baillon, Hist. Pl. 8: 366. 1885. TYPE: *Hypsela reniformis* (Kunth) C. Presl.

THE CORRECT NAME FOR *PRATIA REPENS* S.L. IN *LOBELIA*

Chiapella (1996) used the name *Pratia repens* for the more broadly circumscribed species resulting from the merger. The basionym of *H. reniformis*, *Lysipomia reniformis* Kunth, had been published six years earlier, but its use in *Pratia* was preempted by *P. reniformis* (Chamisso) Kanitz. The situation becomes more complicated when the species of *Pratia* are transferred to *Lobelia*.

Transferring the epithet of *P. repens* to *Lobelia* is precluded by *L. repens* Thunberg. Consequently, I recently (Lammers, 1998a) validated the name *L. pratiana* Gaudichaud ex Lammers, originally suggested by Murata (1995) as a *nomen novum*. This is the correct name in *Lobelia* for *Pratia repens* s. str. However, it is not the correct name for the species in its expanded circumscription.

The epithets of *Hypsela reniformis* and *Pratia longiflora* likewise cannot be transferred to *Lobelia*, due to the existence of *L. reniformis* Chamisso and *L. longiflora* L., respectively. However, the synonymy of *Hypsela reniformis* (Wimmer, 1943; Jeppesen, 1981; Lammers et al., 1993) includes four additional heterotypic names, all of which antedate *Lobelia pratiana*. Two of these have equal priority, and there is no impediment to taking up either epithet. The one that seems more appropriate morphologically is transferred to *Lobelia*, to provide a name in that genus for *Pratia repens* s.l. It would also be the correct name for *H. reniformis* if that species were to be maintained as distinct from *P. repens* but likewise assigned to *Lobelia*. For clarity, complete synonymy is provided here for the species, as circumscribed by Chiapella (1996).

Lobelia oligophylla (Weddell) Lammers, comb. nov. Basionym: *Pratia oligophylla* Weddell, Chlor. And. 2: 10. 1857. *Hypsela oligophylla* (Weddell) Bentham & J. D. Hooker ex Zahlbruckner, Bull. Torrey Bot. Club 24: 387. 1897. TYPE: Peru. Cordillière de Tacora, notamment au voisinage de la métairie de Chunlunquaiani, pelouses un peu marécageuses des *punas*, 4000 m, *Weddell s.n.* (holotype, P not seen).

Lysipomia reniformis Kunth, in H.B.K., Nov. Gen. Sp. 3: 320. 1819; non *Lobelia reniformis* Chamisso, Linnaea 8: 210. 1833. *Hypsela reniformis* (Kunth) C. Presl, Prodr. Monogr. Lobel. 45. 1836. TYPE: Ecuador. Propter speluncam Antisanae, 15,000 ft., *Humboldt & Bonpland s.n.* (holotype, P not seen).

Pratia repens Gaudichaud, Ann. Sci. Nat. 5: 103. 1825; non *Lobelia repens* Thunberg, Prodr. Fl. Cap. 40. 1794. *Lobelia pratiana* Gaudichaud ex Lammers, Novon 8: 34. 1998. TYPE: Falkland Islands. *Gaudichaud s.n.* (holotype, P not seen).

Pratia longiflora J. D. Hooker, Fl. Antarct. 325. 1846; non *Lobelia longiflora* L., Sp. Pl. 930. 1753. *Hypsela longiflora* (J. D. Hooker) F. Philippi, Cat. Pl. Vasc. Chil. 232. 1881. TYPE: Chile. Straits of Magellan, Cape Negro, *Darwin s.n.* (holotype, K not seen).

Pratia subsessilis Weddell, Chlor. And. 2: 10. 1857. *Hypsela subsessilis* (Weddell) Bentham & J. D. Hooker ex Zahlbruckner, Bull. Torrey Bot. Club 24: 387. 1897. TYPE: Bolivia. Province de Cinti, pelouses un peu marécageuses et bords des ruisseaux, dans les *punas*, 3500 m, *Weddell s.n.* (holotype, P not seen).

Pratia atacamensis R. A. Philippi, Fl. Atacam. 208. 1860. *Hypsela atacamensis* (R. A. Philippi) F. Philippi, Cat. Pl. Vasc. Chil. 232. 1881. TYPE: Chile. Frequens ad fontes deserti Atacamensis, Jan.–Feb. 1854, *Philippi s.n.* (holotype, SGO).

Pratia pencana R. A. Philippi, Anal. Univ. Chile 18: 53. 1861. TYPE: Chile. Coquimbo: Huanta, 1860, *Vohkmann s.n.* (holotype, SGO).

Disposition of Orphaned *Hypsela* Species

There remains the question of what to do with the remaining species of *Hypsela*. In the most recent monograph (Wimmer, 1943), three species were recognized in addition to the type. None occur in South America, but rather are endemic to Australasia: *H. rivalis* F. E. Wimmer to New Zealand, and *H. sessiliflora* F. E. Wimmer and *H. tridens* F. E. Wimmer to Australia. These species obviously can no longer go by the name *Hypsela*.

It might be logical to suggest that they follow the generic type into *Lobelia*. However, this would not be an optimal disposition. Even prior to Chiapella's (1996) research, I had suspected that the South American and Australasian elements of *Hypsela* were not congeneric. In the three Australasian species, the staminal column is adnate to the corolla for at least half its length, while in *L. oligophylla* it is free or only adnate to the corolla at its base. Such pronounced adnation is unusual in the subfamily; most genera, including *Lobelia*, are characterized by having the staminal column free from the corolla or only adnate to the corolla at its base (Bentham, 1876; Schönland, 1889; McVaugh, 1943; Wimmer, 1953). Similarly, the entire corolla tube that characterizes these species is an unusual feature in *Lobelia*, occurring in very few species, none of them Australasian.

It might be reasonable to erect a new genus for these three orphans, as no existing genus of Lobelioideae combines their herbaceous habit, creeping prostrate stems, small flowers solitary in leaf axils, corollas with a cylindric entire tube and small subequal lobes, filament tubes adnate to the middle of the corolla tube, ventral anthers with a long flat triangular trichome and tufts of minute hairs at the apex of each, and indehiscent fruits. However, there is one genus in which all these features save one may be found.

Isotoma (R. Brown) Lindley (excluding *Hippobroma* G. Don) comprises 11 species endemic to Australia (Wimmer, 1953; Melville, 1960; Elliot & Jones, 1990). The genus is characterized by its herbaceous habit, corollas with a cylindric entire tube and small subequal lobes, filament tubes adnate to the middle of the corolla tube, ventral anthers with a pair of long setae and tufts of minute hairs at their apex, and apically loculicidal capsules. All but one species, *I. hypocrateriformis* (R. Brown) Druce, have solitary axillary flowers, and two of these, *I. fluviatilis* (R. Brown) F. Mueller ex Bentham and *I. luticola* Carolin, have creeping prostrate stems. As noted by Wimmer (1943), *H. rivalis* bears a striking resemblance to *I. fluviatilis* and has

often been mistaken for it (cf. Allan, 1961; Beuzenberg & Hair, 1959, 1983).

The only feature that distinguishes *Isotoma* from the three orphan species are its capsular fruits. Given current thinking on the inappropriateness of indehiscence as a generic character in Campanulaceae (Moeliono & Tuyn, 1960; Adams, 1972; Wilbur, 1991; Albrecht, 1994; Murata, 1995; Lammers, 1992, 1993, 1998a, 1998b; Morris & Lammers, 1997; Pepper et al., 1997), establishment of a new genus on this basis would be inadvisable. Just as *Lobelia* can accommodate the species of *Pratia*, *Isotoma* is judged to be the best home for the three species orphaned by the synonymization of *Hypsela reniformis*. The requisite combinations are established here.

Isotoma (R. Brown) Lindley, Bot. Reg. 12: pl. 964. 1826. Basionym: *Lobelia* [no rank indicated] *Isotoma* R. Brown, Prodr. 565. 1810. *Laurentia* [no rank indicated] *Isotoma* (R. Brown) Endlicher, Gen. Pl. 512. 1838. *Laurentia* subg. *Isotoma* (R. Brown) Petermann, Pflanzenr. 444. 1845. *Laurentia* sect. *Isotoma* (R. Brown) F. E. Wimmer, Ann. Naturhist. Mus. Wien 56: 335. 1948. TYPE: *Lobelia hypocrateriformis* R. Brown.

Isotoma rivalis (F. E. Wimmer) Lammers, comb. nov. Basionym: *Hypsela rivalis* F. E. Wimmer, Pflanzenr. IV.276b: 121. 1943. TYPE: New Zealand. South Island: Broken River, *Kirk 464* (holotype, CGE not seen).

Isotoma sessiliflora (F. E. Wimmer) Lammers, comb. nov. Basionym: *Hypsela sessiliflora* E. Wimmer, Pflanzenr. IV.276b: 121. 1943. TYPE: Australia. New South Wales: Port Jackson, *Bauer s.n.* (holotype, W not seen).

Isotoma tridens (F. E. Wimmer) Lammers, comb. nov. Basionym: *Hypsela tridens* F. E. Wimmer, Pflanzenr. IV.276b: 121. 1943. TYPE: Australia. Sine loc., *Cunningham s.n.* (holotype, W not seen).

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A New Combination in *Nageia* (Podocarpaceae)

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ABSTRACT. The new combination *Nageia nankoensis* (Hayata) R. R. Mill is proposed, and the affinities of the species with *N. formosensis* and *N. nagi* are discussed briefly. *Nageia nankoensis* is endemic to northern Taiwan, *N. formosensis* only to the south tip of the island; the latter is not native in northern Taiwan as mis-stated by some authors. It is shown that this error may have arisen because of a wrong citation of the type of *N. formosensis* by Li, which has been followed in later literature.

The revision of the gymnosperms for the *Flora of China* is in progress. Following the views of many authors, *Nageia* Gaertner (Podocarpaceae) is here regarded as a genus separate from *Podocarpus* L'Héritier ex Persoon. Indeed, *Nageia* was recently raised to family rank, as Nageiaceae, by Fu (1992). This ranking is not accepted here, pending further work in progress on Podocarpaceae sensu lato at the Royal Botanic Garden Edinburgh. However, Fu's generic limits of *Nageia* agree with those adopted by me for the *Flora of China* treatment. De Laubenfels (1969, 1987) took a much broader view of the genus and included various species from Africa, South America, and the Australasia-Pacific region, which Page (1989) segregated as the genera *Afrocarpus* C. N. Page and *Retrophyllum* C. N. Page.

In the *Flora of China*, it is proposed to recognize the taxon *Podocarpus nankoensis* Hayata at species rank within *Nageia*. Most other necessary combinations in *Nageia* have been made by de Laubenfels (1987) and Page (1989). However, *Podocarpus nankoensis* was regarded as a synonym of *N. nagi* (including *N. formosensis*) by de Laubenfels, and of *N. formosensis* by Page.

Nageia nankoensis (Hayata) R. R. Mill, comb. nov. Basionym: *Podocarpus nankoensis* Hayata, Icon. Pl. Formos. 7: 39. 1918. TYPE: [Taiwan]. "Hab. Nanko, leg. B. Hayata Mai 1916" (holotype, TI not seen).

Nageia nankoensis and *N. formosensis* (Dummer) C. N. Page are both endemic to Taiwan. The latter was based on *Podocarpus formosensis* Dummer, the type of which (*Henry 1357*, K) was collected by Schmüser at the extreme south tip of the island. Unfortunately, Li and Keng (1954: 43) and Li (1963: 40) have wrongly stated that the type of *N. formosensis* is *Henry 1446*, which was collected at Tamsui (Tanshui) at the north end of the island. This has led to considerable confusion between *N. formosensis* and *N. nankoensis* in some later literature, including the sinking of the latter as a synonym of the former by Page (1989) and the citation of *N. formosensis* as occurring in northern Taiwan by Li (1963). The two plants are in fact separable by leaf and branch characters and are here recognized as separate species, as was done under *Podocarpus* by Hu (1964: 33, 35). This has necessitated a new combination in *Nageia* for *Podocarpus nankoensis*. Hu's distribution information for both species is correct.

Nageia formosensis is distinguishable from *N. nankoensis* and *N. nagi* (Thunberg) Kuntze, by its leaf morphology: many leaves are obovate or obovate-elliptic rather than lanceolate or ovate-elliptic, and those that are obovate have very broad, truncate tips, which are frequently blackened (Dummer likened this character to them having been touched by a hot iron). Obovate leaves have not been seen in any specimens of *N. nagi* or *N. nankoensis*, although leaf shape in both is variable, particularly in length: width ratio. (This has led to the recognition of varieties within *N. nagi* as represented in Japan). *Nageia formosensis*, which only occurs in southern Taiwan, has been recently reduced to varietal rank, as *N. nagi* var. *formosensis* (Dummer) J. Silba (Silba, 1990: 38), but this seems too low a rank; if a broad concept of *N. nagi* is preferred, *N. formosensis* should be recognized as a subspecies of it.

Nageia nankoensis is more similar to *N. nagi* than it is to *N. formosensis* but tends to have narrower, more distinctly lanceolate leaves. It is endemic to northern Taiwan. Specimens from Hainan that have been identified as *N. nankoensis* (e.g., *McClure 8131* (E, K) from Nodoa; *C. I. Lei 745* (K) from Ku Tung Village; *W. T. Tsang 17430* (E, K) from Paak Shek Shan) all have broader, much more

broadly obtuse leaves than any plants of *N. nankoensis* from Taiwan. They have been compared with specimens of *N. nagi* from Japan and China and showed no significant differences. Therefore, these Hainan plants are here considered to belong to *N. nagi*. This accords with the identifications of Hu (1964: 35–36), who came to the same conclusion.

Both *Nageia formosensis* and *N. nankoensis* were included in the long synonymy of *N. nagi* (as *Decussocarpus nagi* (Thunberg) de Laubenfels) by de Laubenfels (1969: 357). His concept of *N. nagi*, and of other species of *Nageia*, was very broad.

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A New Species of *Larix* (Pinaceae) from Southeast Tibet and Other Nomenclatural Notes on Chinese *Larix*

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ABSTRACT. *Larix kongboensis*, a new species from southeastern Xizang (China) near its borders with Arunachal Pradesh (India), is described. Previously misidentified as *L. mastersiana*, its affinities with that Sichuan endemic and with *L. griffithii* (eastern Himalaya) and *L. speciosa* (Yunnan, Myanmar) are discussed. Within *L. potaninii* Batalin, variety *australis* A. Henry ex Handel-Mazzetti has been found to be an earlier name for variety *macrocarpa* Y. W. Law. The nomenclature of the "Sikkim Larch" is discussed, and it is concluded that *Larix griffithii* J. D. Hooker, not *L. griffithiana* Carrière, is the correct name for this species.

In the course of revising the genus *Larix* for the *Flora of China*, it was discovered that three specimens from southeastern Xizang named by their original collector as *L. mastersiana* were not that species. Because they do not match any other species in the group with exserted, reflexed bract scales, they are described below as *L. kongboensis*.

Larix kongboensis R. R. Mill, sp. nov. TYPE: China. Xizang: Tamnyen La, 29°18′N, 94°45′E, alt. 11,000 ft. [3353 m], 21 July 1938, *F. Ludlow, G. Sherriff & G. Taylor 4914* (holotype, E; isotype, BM; female cones and mature leaves of current year).

Affinis *L. griffithii* J. D. Hooker bractearum apicibus sursum curvatis sed foliis multo minoribus, aestate tantum 9–22 mm (non 30–55 mm) fasciculis densioribus foliorum 40–50 (non 28–36), brachyblastis fertilibus foliatis, strobilis masculis multo brevioribus (6–8 mm, non 10–16 mm) rubescentibus (haud flavescentibus), strobilis femineis maturis 2-plo (non 2.5–3-plo) longioribus quam latioribus differt. A *Larice mastersiana* Rehder & Wilson apicibus brachyblastorum glabris (non densiuscule flavidopilosis), brachyblastis brevioribus et angustioribus, epidermide foliorum epapillosa, foliis in fasciculis magis numerosis (40–50, non 25–40), et apicibus bractearum sursum curvatis recedit.

Trees, 9–25 m tall. Bark and branching habit unknown. Long shoots of first year not seen, of second year pale reddish brown, glabrous, of subsequent years pale gray. Short shoots 2–4.5 × 4.5–6 mm, broadly obconical; leaf cushions glabrous. Leaves in fascicles of 40–50, linear-oblong, straight or slightly falcate, 6–12 mm in spring, finally 9–22 × 0.6–1.1 mm; midrib raised adaxially only proximally; stomatal lines 3–5 on each side of midrib abaxially, none adaxially; epidermis not papillose. Cone-bearing short shoots with leaves; cones short pedunculate (peduncle not more than 4 mm). Pollen cones erecto-patent at 45°, reddish, broadly conical, 6–8 × 5.5–6.5 mm. Seed cones at flowering stage not seen. Cone deflexed outward from main shoot axis, gray-brown when ripe, oblong-ellipsoid, 4.5–5 × 2.2–2.5 cm; seed scales broadly obovate-reniform, median ones ca. 8 × 10 mm, apex broadly rounded, entire or shallowly retuse, abaxial surface minutely whitish pubescent; bract scales exserted, lanceolate, exposed part ca. 8 × 5.5 mm, strongly reflexed, tapered gradually then finally more abruptly into a cusp; cusp 1.5–4 mm, turned upward at tip. Seeds not seen. Flowering April. Fruiting late summer–autumn.

The three specimens cited and described as the new species *Larix kongboensis* were all originally named as *L. mastersiana* Rehder & Wilson, and one of them is also mentioned under that name in a quotation from Ludlow and Sherriff's journal (Fletcher, 1975: 88), where the trees concerned are described as "a very fine larch." The area of southeastern Tibet (Xizang, China) in which the specimens were collected lies in Kongbo, from which the epithet is derived. This area, close to the border with Arunachal Pradesh (northeastern India), has yielded numerous new endemic species, primarily as a result of the collecting expeditions by Ludlow et al. and by F. Kingdon-Ward.

Larix mastersiana Rehder & Wilson is an endangered species, endemic to a small area of western Sichuan. It differs from *L. kongboensis* in several characters, notably the pale yellowish-pilose leaf "cushions," longer and relatively narrower short shoots, fewer (25–40) leaves per fascicle which have a papillose epidermis, and the bract scales whose apical cusp is not turned upward at the tip.

Larix kongboensis is closer to *L. griffithii* in its characters and distribution, and the latter occurs in Bhutan, Nepal, and Sikkim, and has been recorded from Xizang (Law et al., 1978: 171–173). It is possible that at least some of the Xizang records of *L. griffithii* actually belong to *L. kongboensis*. *Larix griffithii* differs by its fewer, much longer leaves (3–5.5 cm), its usually leafless cone-bearing short shoots, much larger, yellowish pollen cones, and seed cones twice as long and 2.5–3× as long as broad (not 2× as long as broad). Characters *L. kongboensis* shares with *L. griffithii* but not *L. mastersiana* include the upturned apex of the bract scales, the non-papillose leaf epidermis, and the glabrous leaf cushions.

The only other Chinese larch with reflexed bract scales is *Larix speciosa* W. C. Cheng & Y. W. Law. Specimens of this have been seen from Yunnan as well as northern Myanmar; again, it has been recorded from Xizang but verification is necessary. It is easily separable from *L. kongboensis* by its stout, often very long short shoots (up to 3 cm), longer leaves (2.5–5.5 cm), pollen cones much larger (1.6–2.2 cm), chocolate-colored mature cones, and bract scales whose apical cusp is not turned upward at the tip.

Paratypes. CHINA. **Southeastern Xizang:** Lunang, Rong Chu, Kongbo, 29°44′N, 94°48′E, 10,500 ft. [3200 m], fairly common at the upper limit of spruce and pine, 12 Apr. 1947, *F. Ludlow, G. Sherriff & G. Taylor 12376* (BM, E; male cones and old female cone of previous year); Natrampa-Lung, Chayul Chu, 11,500 ft. [3505 m], tree 30–80 ft., rocky slopes and rhododendron and bamboo jungle, transition zone, 27 Apr. 1936, *F. Ludlow & G. Sherriff 1367* (E, BM; spring leaves).

Larix potaninii Batalin var. **australis** A. Henry ex Handel-Mazzetti, Symb. Sin. 7(1): 14. 1929. TYPE: China. NW Yunnan: "prope fines Tibeto-Birmanicas inter fluvios Lu-djiang (Salween) et Djiou-djiang (Irrawadi or. sup.), in jugi Tschiangschel, 27°52′[N], lateris utriusque regione temperata in silvis mixtis, substr. micoschistaceo," 2850–3500 m, 2 & 5 July 1916, *H. F. von Handel-Mazzetti 9176 (Diar. Nr. 1754,[17]70)* (holotype, W not seen; isotype, E). (The fourth character of the Diar. Nr. is difficult to decipher but is assumed to be a 4.)

Larix potaninii Batalin var. *macrocarpa* Y. W. Law, in W. C. Cheng, L. K. Fu & C. Y. Cheng, Acta Phytotax. Sin. 13(4): 84. 1975. Syn. nov. TYPE: China. Central Yunnan: 2800–3600 m, *Feng Guomei 9347* (holotype, PE not seen).

Augustin Henry's neglected varietal epithet appears as a very brief note in Handel-Mazzetti's account of *Larix* (Handel-Mazzetti, 1929), but as the minuscule description mentions that the cones are 7 cm long, it is sufficient to equate the name with Y. W. Law's variety *macrocarpa* based on material from Muli, southwestern Sichuan. The Edinburgh isotype (*Handel-Mazzetti 9176*) consists of two packets mounted on a herbarium sheet, one containing only leaves and bearing a label "*Larix Potaninii* Bat. var. nova *australis* Henry det. A. Henry," the other containing only cones and unlabeled, but with a loose ticket within labeled "ad No. 9176 *Larix Potaninii* var. *australis.*" This ticket seems to be a discarded label (for *Handel-Mazzetti 8323*) that has been torn in half and re-used. Three of the four cones measure 4.8–5.5 cm; the fourth is slightly incomplete. They are thus at the minimum of the range allowed for variety *macrocarpa* by Y. W. Law, and at the maximum found in variety *potaninii*. They are also smaller than variety *australis* as described by Handel-Mazzetti.

Larix griffithii J. D. Hooker, Himal. Journal 1: 255–256 (as "Saar," without Latin name), 2: 44 & 481 (Jan. 1854). SYNTYPES: [Nepal] Nango Mt., *J. D. Hooker* (K); [Sikkim] Lachen, *J. D. Hooker & Thomson* (K).

Abies griffithiana J. D. Hooker ex Lindley & Gordon, J. Roy. Hort. Soc. London 5: 214. 1850, nom. subnud. No type designated.

Larix griffithiana hort. ex Carrière, Traité Gen. Conif. 278. Jun. 1855.

The name of the Sikkim larch has vacillated between *Larix griffithiana* and *L. griffithii* almost since the species was first named, due in part to the two epithets appearing within one month of each other. There is disagreement even in the most recent treatments: Grierson and Long (1983) used *L. griffithiana* Carrière, Farjon (1990) *L. griffithiana* (Lindley & Gordon) Carrière, and Silba (1986) *L. griffithii* Hook. f. A similar confusion exists when several popular books on trees are compared.

Carrière's epithet *griffithiana* originally appeared as *Abies griffithiana* J. D. Hooker ex Lindley & Gordon (1850). However, Lindley and Gordon's description merely reads "A tree 40 to 60 feet high (The Sikkim Larch)"; the distribution, "Eastern Nepal, Sikkim," is also given. This description contains no characters that diagnose this larch against any other species of *Larix*, or indeed against any other tree. It is not considered enough to validate Lindley and Gordon's name, and the epithet *griffithiana* should be considered to date from Carrière's first adequate description, published in June 1855.

Hooker's epithet *griffithii* is generally considered

to date from July 1855, when it appeared in Hooker's *Illustrations of Himalayan Plants* (Hooker, 1855) as *Larix griffithii* J. D. Hooker & Thomson; Hooker himself (1888) cited this reference as the place of publication, with *L. griffithiana* Gordon, *Abies griffithiana* Lindley & Gordon, and *Pinus griffithii* Parlatore listed as the only synonyms. It would thus be antedated, by one month, by *L. griffithiana* Carrière, of whose publication Hooker (and also Bean, 1908) seems to have been unaware; hence the preponderance of use of *griffithiana* in most, but not all, recent literature, including *Flora Reipublicae Popularis Sinicae.*

However, Hooker also published the name in his *Himalayan Journals* (Hooker, 1854), both volumes of which were published in January 1854, 18 months before *Larix griffithiana* Carrière. In volume 1, pp. 255–256, there is a detailed description of a larch, with two vernacular names, but no Latin epithet. Hooker had discovered the tree at Nango Mountain, eastern Nepal (Bean, 1908). The description reads as follows: "*December* 5 [1848].– . . .We descended at first through rhododendron and juniper, then through black silver-fir (*Abies Webbiana*), and below that, near the river, we came to the Himalayan larch; a tree quite unknown, except from a notice in the journals of Mr. Griffith, who found it in Bhotan. It is a small tree, twenty to forty feet high, perfectly similar in general characters to a European larch, but with larger cones, which are erect upon the very long, pensile, whip-like branches; its leaves,–now red–were falling, and covering the rocky ground on which it grew, scattered amongst other trees. It is called 'Saar' by the Lepchas and Cis-Himalayan Tibetans, and 'Boarga-sella' by the Nepalese, who say it is found as far west as the Cosi river; it does not inhabit Central or West Nepal, nor the North-West Himalaya."

The first actual mention of the name *Larix griffithii* is in volume 2, p. 44, which is the usual citation found in the literature, generally qualified by the statement "nomen" or "nom. nud." (e.g., Bean, 1908). Hooker was here describing the conifers of a steep hill in the Lachen valley, near a point where the river divides, and where some stacks of different conifer woods were stored for export to Tibet. Discussing this wood pile, Hooker wrote, "Of these the larch (*Larix Griffithii*, 'Sah') splits well, and is the most durable of any; but the planks are small, soft and white."

The vernacular name "Sah" is presumably a different rendering of "Saar" used in volume 1, p. 255, and could be used to argue that he was referring in both places to the same taxon. However, what is more significant is that it is clear from the index to the whole work that the plant supplied with a full description but no Latin name in the first volume belongs to the same species as the one given a name but only a description of its sawn planks in the second. The index entries on p. 481 of volume 2 read:

Larch, Himalayan, i. 255; sketch of, ii. 55.

Larix Griffithii, i. 255; ii. 44.

From these it is obvious that Hooker knew that his description of "Saar" in the first volume was of *Larix griffithii*, which should thus not be considered a *nomen nudum* in this publication but validated by an indirect reference (Art. 32.5 of ICBN, Greuter et al., 1994), via the index, to the description in volume 1. Since the two volumes were simultaneously published, the name can be taken to date from January 1854. *Larix griffithii* Hooker is thus the correct name for the Sikkim Larch. "Sikkim Larch" (as used by Mitchell, 1974) is a better English name for this species than "Himalayan Larch," which is sometimes used (as for example by Hooker), because of the existence of another Himalayan larch, *L. himalaica* W. C. Cheng & L. K. Fu.

As Hooker (1854) mentioned incidentally, *Larix griffithii* was in fact first discovered by William Griffith, on 10 May 1838, in Bhutan, "above Woolookha, 9,600 ft." Griffith (1848: 189, no. 1010) gave a short Latin description: "Arbor parva, ramulis elongatis pendulis, foliis plurimis complanatis, conis ascendentibus, squamis rubro fuscis, longe apiculatis, apiculo viridi deflexo." However, his entry is merely labeled "Larix sp." The supporting specimen is at K.

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Hylaea (Apocynaceae–Apocynoideae), a New Genus from South America

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ABSTRACT. The genus *Hylaea*, restricted to Venezuelan–Brazilian Amazonia, is described here. Two new combinations, *Hylaea arborescens* and *H. leptoloba*, are proposed.

As a result of recent study of material of *Prestonia* (Apocynaceae) from throughout its range and during preparation of the accounts of the Apocynaceae for the *Flora Mesoamericana* and the *Manual to the Plants of Costa Rica*, it became evident that the delimitation of *Prestonia* needed critical study and that several nomenclatural adjustments were appropriate. Recently, some effort toward resolution of these nomenclatural problems in *Prestonia* has been made (Morales, 1996, 1997a, 1997b). *Prestonia leptoloba* and *P. arborescens*, described and included in *Prestonia* by Monachino (1957, 1961), possess a different corolla structure (stamens completely exserted, absence of the annular corona in the orifice of the corolla tube) that does not allow inclusion of these taxa in *Prestonia*. Therefore, a new genus is here created with two new necessary combinations.

Hylaea J. F. Morales, gen. nov. TYPE: *Hylaea leptoloba* (Monachino) J. F. Morales.

Herba volubilis vel arbor parva, *Prestoniae* et *Laubertiae* affinis; folia opposita petiolata ad coriacea eglandulifera; inflorescentia subcorymbosis lateralis pedunculata multiflora; corolla regularis 5-partita infundibuliformis vel hypocrateriformis appendicibus epistaminalibus exserta inconspicue stamina exserta puberulus annulo faucium absens; fructus ignotus.

Suffruticose lianas or small trees. Stems subterete to somewhat flattened, inconspicuously puberulent to glabrate, inconspicuously lenticellate, latex unknown. Leaves opposite, coriaceous, glabrous, colleters absent at the base of the leaf blade, petiole slightly fused at the base, mostly with colleters in the axils. Inflorescence a subcorymbose or subcorymbose-umbelliform cyme, axillary, minutely puberulent to glabrous or glabrate, many-flowered, usually long-pedunculate, bracts foliaceous or scarious. Flowers: sepals scarcely imbricate at the base, bearing a solitary episepalous colleter within, subentire to inconspicuously erose, corolla infundibuliform or salverform, glabrous without, free corona appendages, completely exserted, inserted in the orifice of the corolla mouth, the limb 5-parted, actinomorphic, dextrorsely convolute, stamens 5, totally exserted, infrastaminal indument within, anthers connivent and agglutinated to the pistil head, densely puberulent, consisting of 2 parallel, uniformly fertile thecae borne adaxially near the apex of an enlarged, sagittate, 2-auriculate, sterile part of the anther, auricles short, acute to short-acuminate, filaments short, puberulent to pilose, carpels 2, united at the apex by a common stylar shaft surmounted by the fusiform style head, ovary glabrous, ovules numerous, multiseriate, nectaries 5, separated. Follicles unknown.

Hylaea comprises two species restricted to Venezuelan–Brazilian Amazonia. The generic name recalls the area where the plants were collected.

KEY TO THE SPECIES OF *HYLAEA*

1a. Tree; leaf blades 6–10.5(–12) × 2.4–4(–5) cm; inflorescence bracts 0.1–0.2 cm, scarious . . . . . *H. arborescens*

1b. Liana; leaf blades (13–)26–30 × (6–)12–13.5 cm; inflorescence bracts 0.7–1 cm, foliaceous, early caducous . . . . . *H. leptoloba*

Hylaea arborescens (Monachino) J. F. Morales, comb. nov. Basionym: *Prestonia arborescens* Monachino, Mem. New York Bot. Gard. 10: 63–64, fig. 43E–M. 1961. TYPE: Venezuela. Amazonas: Rio Guainía, occasional along Caño San Miguel just above Limoncito, 15 km from Río Guainía, 100–400 m, 28 June 1959 (fl), *Wurdack & Adderley 43232* (holotype, NY; isotypes, F, INB, MO, VEN; photograph, INB ex F).

Tree 4–5 m tall; branchlets inconspicuously puberulent to glabrous or glabrate, inconspicuously lenticellate. Leaves: petiole 0.4–0.8(–1) cm; blade 6–10.5(–12) × 2.4–4(–5) cm, coriaceous, elliptic to oblanceolate, obtuse to acute at the apex, acute

basally, glabrous; secondary veins slightly impressed, veinlets inconspicuous. Inflorescense subcorymbose-umbelliform, axillary, ± agglomerate, many-flowered, minutely puberulent to glabrous or glabrate; peduncle 4.5–8.5(–10) cm; pedicels 2.5–5(–6) cm; bracts ca. 0.1–0.2 cm, scarious. Flowers: sepals 2–3 × 1.5–3 mm, ovate, acute to obtuse, subcoriaceous, minutely puberulent to glabrate; colleters ca. 0.5 mm long, subentire to inconspicuously erose; corolla narrowly infundibuliform, white and pink-tinged, glabrous; tube 8–10 × 3.5–4 mm; corona lobes less than 1 mm, annular corona absent; lobes 0.9–1.2(–1.5) × 0.6–0.9(–1.2) cm, obovate; anthers 6 mm, densely puberulent, totally exserted; ovary 1–1.5 mm long; style head ca. 1.5 mm long; nectaries about equaling the ovary, separate, entire. Follicles unknown.

This species, known only from the type collection, is restricted to Venezuelan Amazonia. It is characterized by its arborescent habit, coriaceous leaves, free corona appendages, lack of an annular corona, and completely exserted anthers. The most important characters on which the segregation of *Hylaea* from *Prestonia* are based are the absence of an annular corona and the totally exserted anthers. The close affinity of *Hylaea* with *Prestonia* is exemplified by the free corona lobes and corymbose to subcorymbose inflorescences, present in both genera.

Although Monachino (1961) and Morillo (1978, 1995) included this species within *Prestonia*, careful examination of the type collection showed significant differences with respect to the main characters of that genus. Both authors mentioned the presence of a papillose faucal annulus; however, careful examination of the flowers revealed that it is absent.

In *Prestonia* the annular corona is always situated in the corolla mouth and below this, within the tube, are the free corona lobes (when present) or the callus ridges. In the flowers of *Hylaea arborescens*, the appendages are superimposed over the purported annular corona, which is really composed only of a thickening of the adpressed pubescence of the corolla tube within: a true annular corona is not present.

Following Morales (1997a), the presence of an annular corona is one of the most important features that separate *Prestonia* and *Laubertia* from other closely related genera. Both genera are easily distinguished by this character, which is present in all the species. Other species (e.g., *P. woodsoniana* (Monachino) A. H. Gentry, *P. caudata* Woodson, and *P. agglutinata* (Jacquin) Woodson) previously included in *Prestonia* but which lack an annular corona were recently transferred to *Echites* (Morales, 1997b).

In some Mesoamerican species of the section *Tomentosae* (e.g., *P. clandestina* J. F. Morales, *P. mexicana* A. DC., *P. speciosa* Donnell Smith), the annular corona is conspicuously five-lobed and somewhat reduced, but is always present. In some South American species (e.g., *P. solanifolia* (Müller Argoviensis) Woodson) the annular corona is very reduced but always visible. Therefore, following the generic concepts put forward by Woodson (1933, 1936) and Pichón (1950), and in conjunction with the foregoing rationale, *Prestonia arborescens* Monachino should not be included within *Prestonia* because other closely related genera such as *Laubertia* would then also be drawn in to *Prestonia*.

The genus *Hylaea* can be separated from most closely related genera by the following key:

1a. Anthers totally exserted; annular corona absent . . . . . *Hylaea*

1b. Anthers included or with the apices partially exserted, never totally exserted; annular corona present, conspicuous or inconspicuous.

2a. Sepals with colleters within . . . . . *Prestonia* (including *Rhodocalyx*)

2b. Sepals without colleters within . . . . *Laubertia*

During the course of an examination of *Prestonia* types from South America, another species of *Hylaea* was found. Previously included in *Prestonia* by Monachino (1957), it is characterized by its scandent habit and larger leaves. Therefore, a new combination is necessary and is proposed here.

Hylaea leptoloba (Monachino) J. F. Morales, comb. nov. Basionym: *Prestonia leptoloba* Monachino, Phytologia 6: 12. 1957. TYPE: Brazil. Amazonas: Iraruca, Içana, 16 Nov. 1945 (fl), *Fróes 21391* (holotype, NY; isotypes, IAN, INB; photocopy, INB ex IAN).

Liana; branchlets inconspicuously puberulent to glabrate, inconspicuously lenticellate. Leaves: petiole 0.1–0.2 cm; blade (13–)26–30 × (6–)12–13.5 cm, coriaceous, elliptic to broadly elliptic, subabruptly acuminate at the apex, obtuse basally, glabrous; secondary veins slightly impressed, veinlets inconspicuous. Inflorescence subcorymbose, axillary, ± agglomerate, many-flowered, glabrous to glabrate; peduncle 4.5–6 cm; pedicels 2–5.5 cm; bracts 0.7–1 cm, foliaceous, early caducous. Flowers: sepals 2–3 × 1.5–2 mm, ovate, acute, subcoriaceous, minutely puberulent to glabrate; colleters ca. 0.5 mm long, subentire; corolla salverform, white and purple-tinged, glabrous; tube 9–10 × 3–4 mm; corona lobes less than 1 mm; annular corona

absent; lobes 0.9–1 × 0.5–0.6 cm, narrowly obovate; anthers ca. 6 mm, densely puberulent; ovary less than 1 mm; style head ca. 1.5 mm; nectaries surpassing the ovary, separate, entire. Follicles unknown.

Known only from the type collection. *Hylaea leptoloba* is closely related to *H. arborescens*, but differs by its scandent habit, larger leaves, and conspicuously foliaceous inflorescence bracts.

Acknowledgments. I thank the curators and directors of A, AAU, ALCB, B, BHCB, BM, BR, C, CAS, CEN, COAH, COL, DS, DUKE, ECON, ESAL, F, G, GH, GOET, K, HB, HBG, HRB, HUA, IAN, INPA, LZ, M, MG, MO, NY, O, QCA, QCNE, TRIN, R, RB, S, U, UB, UC, UPS, US, USF, USJ, W, VIC, and Z for the loan of material. I thank Michael Grayum for critical comments on the manuscript.

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A New Species of *Macoubea* (Apocynaceae) from Mesoamerica

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ABSTRACT. A new species of *Macoubea* from Costa Rica and Panama is described and illustrated. Its relationships with the two South American species of the genus are discussed.

Macoubea has been considered to comprise just two primarily South American species, *M. guianensis* and *M. sprucei* (Allorge, 1985), with some specific varieties. Nevertheless, recent work on the Apocynaceae for "The Manual to the Plants of Costa Rica" and the *Flora Mesoamericana* demonstrate the existence of a third species, endemic to Mesoamerica, which is described here.

Macoubea mesoamericana J. F. Morales, sp. nov.

TYPE: Costa Rica. Limón: Cantón de Talamanca, Amubri, camino lastreado al SO del pueblo, 24 June 1989, *Hammel et al. 17516* (holotype, INB; isotypes, CR, F, MO, NY).

[Specimens have been distributed as *Macoubea sprucei* (Müller Argoviensis) Markgraf.]

Arbor parva. Folia elliptica, 12–19(–21.5) × 5–12.5(–14) cm, glabra, subcoriacea. Inflorescentiae terminales, sepala 1.5–2 mm, corollae tubo 3–5 mm, lobis 7–9 × 4 mm. Fructus 4.5–7 × 2.8–3.6 cm, seminibus 1.3–1.5 × 0.4–0.5 cm.

Trees 10–50 m high; branchlets terete to subterete, glabrous to glabrate. Leaves petiolate; petiole glabrous, 1–3 cm long; blade 12–19(–21.5) × 5–12.5(–14) cm, firmly membranaceous to subcoriaceous, broadly elliptic; acuminate to acute at the apex, cuneate basally; glabrous on both sides; secondary veins brochidodromous; veinlets conspicuously reticulated. Inflorescence corymbose, many-flowered, agglomerate, terminal, rarely subterminal, glabrous to glabrate; peduncle 0.8–3.4 cm long; pedicels 0.2–0.6 cm long; bracts ovate, ca. 1 mm long, fimbriate, conspicuous. Flowers greenish yellow, yellowish to white; sepals broadly ovate, 1.5–2 mm, obtuse to rounded, imbricate, glabrous to glabrate, marginally ciliate, bearing many colleters inside; corolla salverform, tube 3–5 mm long, ca. 2 mm wide, sparsely puberulent to glabrate without; lobes obliquely obovate to narrowly obovate, 7–9 × 4 mm, spreading to somewhat reflexed; stamens inserted near the base of the corolla tube; filaments sparsely puberulent; anthers narrowly oblong, 4–4.5 mm, glabrous, acuminate, sagittate at the base; ovary ca. 2 mm, puberulent, 2-carpellate; pistil head ca. 1 mm. Fruits 4.5–7 × 2.8–3.6 cm, hemisyncarpous, moderately to obscurely bilobed, the locules rounded; seeds 1.3–1.5 × 0.4–0.5 cm, oblong, finely rugose, minutely pitted and naked.

Macoubea mesoamericana is known only from southeastern Costa Rica, on the Atlantic slopes of the Cordillera de Talamanca, and Panama, near El Llano–Cartí road, at 200–500 m. Flowering September–March. Fruiting November–April.

Although this species was previously considered

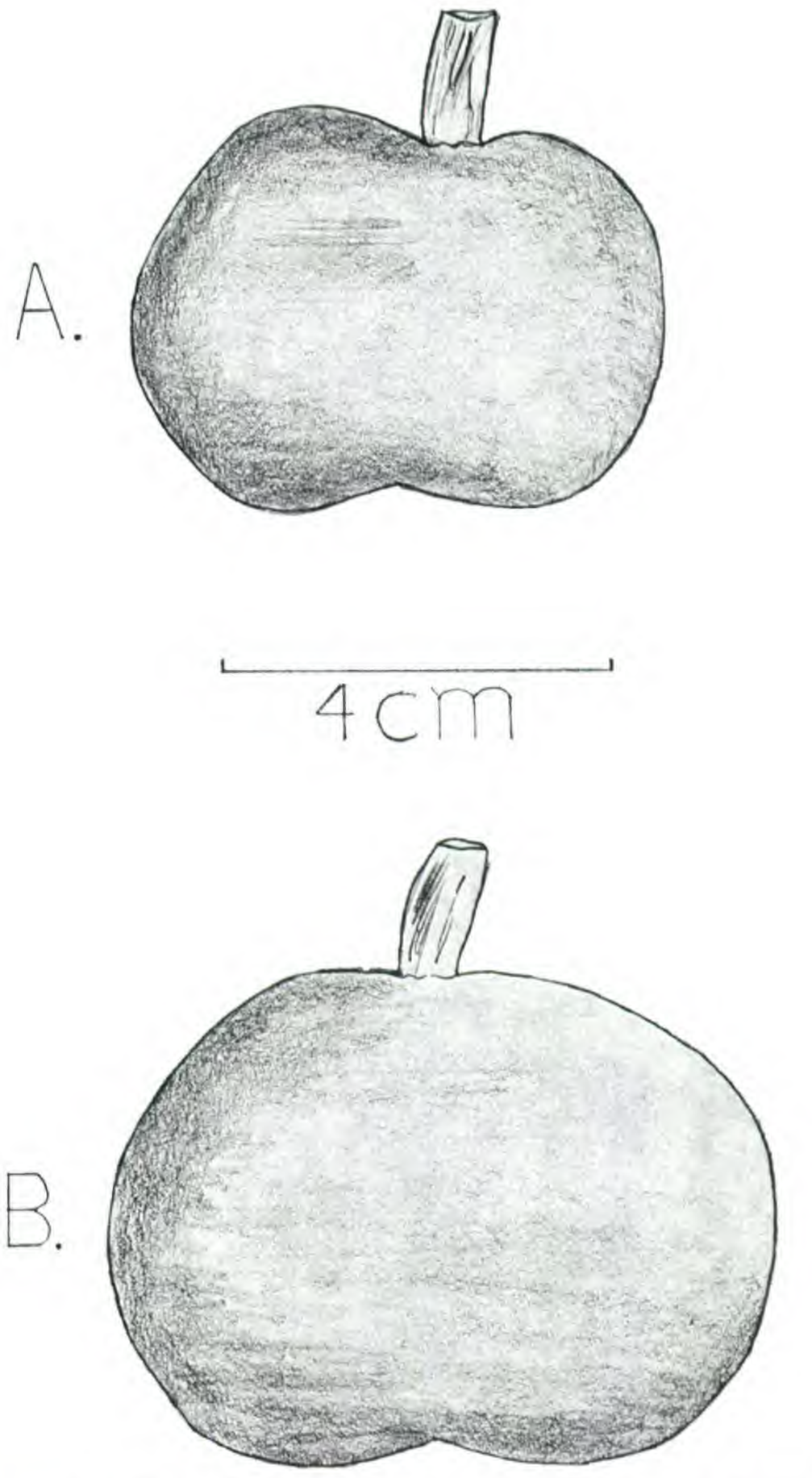

Figure 1. Fruits of *Macoubea mesoamericana* J. F. Morales. —A. *Herrera 3343*. —B. *Chacón 185*.

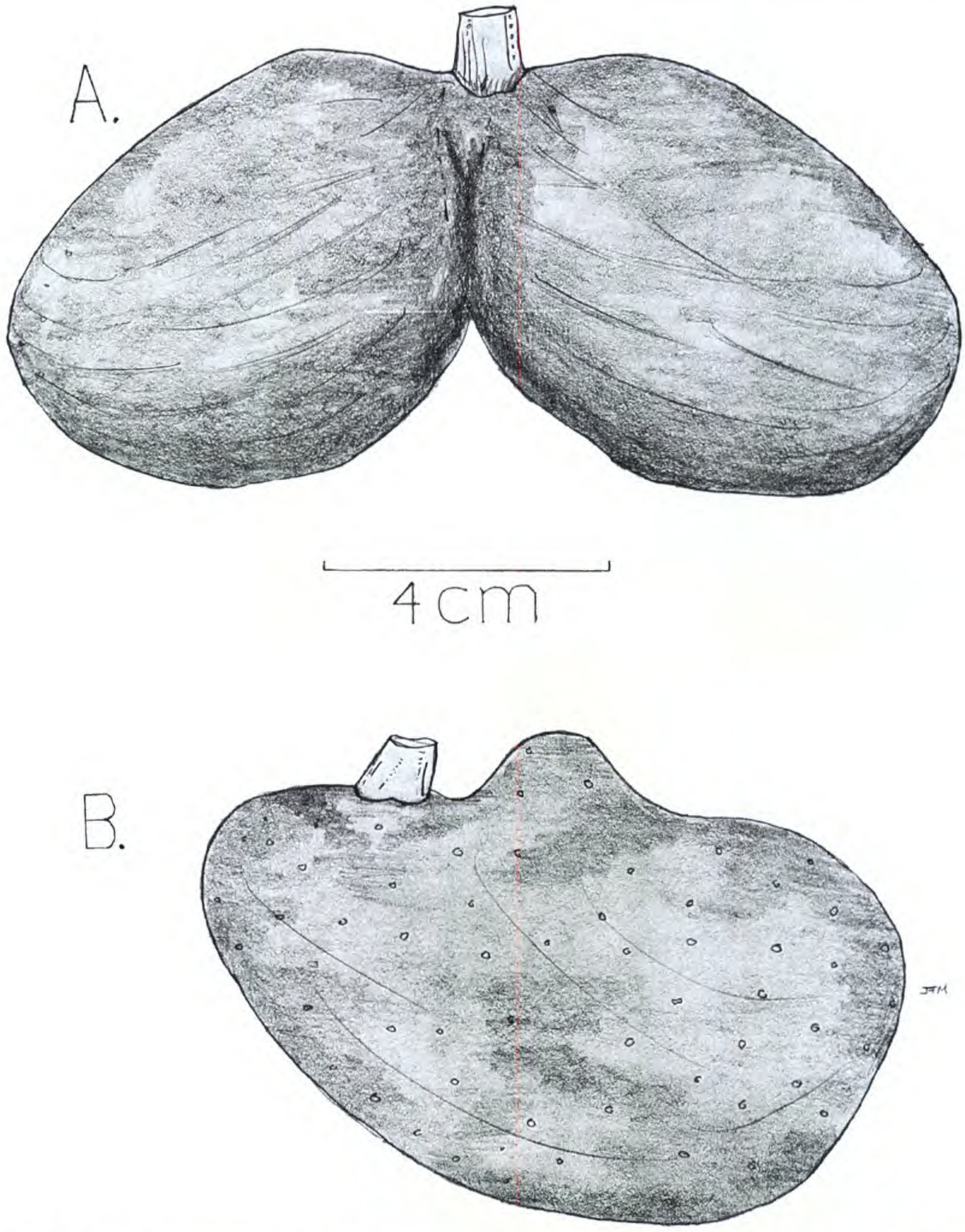

Figure 2. Fruits of *Macoubea sprucei* (Müller Argoviensis) Markgraf. —A. *Revilla 3747.* —B. *Schultes 26072.*

as *Macoubea sprucei* (Allorge, 1985; Gentry, 1974), there are great differences between the two species. In the treatment of Allorge (1985), plate 76 of *M. sprucei* based on the Panamanian specimens represents *M. mesoamericana.* An explanation is in order.

The fruits of *Macoubea mesoamericana* are always hemisyncarpous, moderately to obscurely bilobed (Fig. 1). In *M. sprucei* (Fig. 2) the fruits are reniform and formed by two fused carpels, despite the fact that the fruits are sometimes reduced to only one locule by abortion (e.g., the type of *M. witotorum,* a synonym of *M. sprucei*). Of the approximately 40 fruiting collections examined from South America none had fruits like those of the Mesoamerican collections. In addition, the fruits of *M. mesoamericana* are always conspicuously shorter than *M. sprucei.*

Another difference is found in the seed texture (Fig. 3). In *Macoubea mesoamericana* the seeds are minutely and finely rugose, inconspicuously and minutely pitted, features consistent in all the collections available. The seeds of *M. sprucei* and *M. guianensis* are coarsely rugose, but with conspicuous and irregular depressions along the testa. In addition, *Macoubea sprucei* and *M. guianensis* are restricted to Amazonia, while *M. mesoamericana* is known only from Costa Rica and Panama. The three species have similar flowers and leaves; sometimes it may be difficult to separate *Macoubea sprucei* from *M. guianensis.* Also the texture and pubescence of the leaves are highly variable (Monachino, 1945). Many species and intraspecific varieties were recognized previously by Monachino (1945) and Allorge (1985). However, the recognition of varieties based only on these characters seems unwarranted.

Paratypes. COSTA RICA. **Limón:** Talamanca, Bratsi,

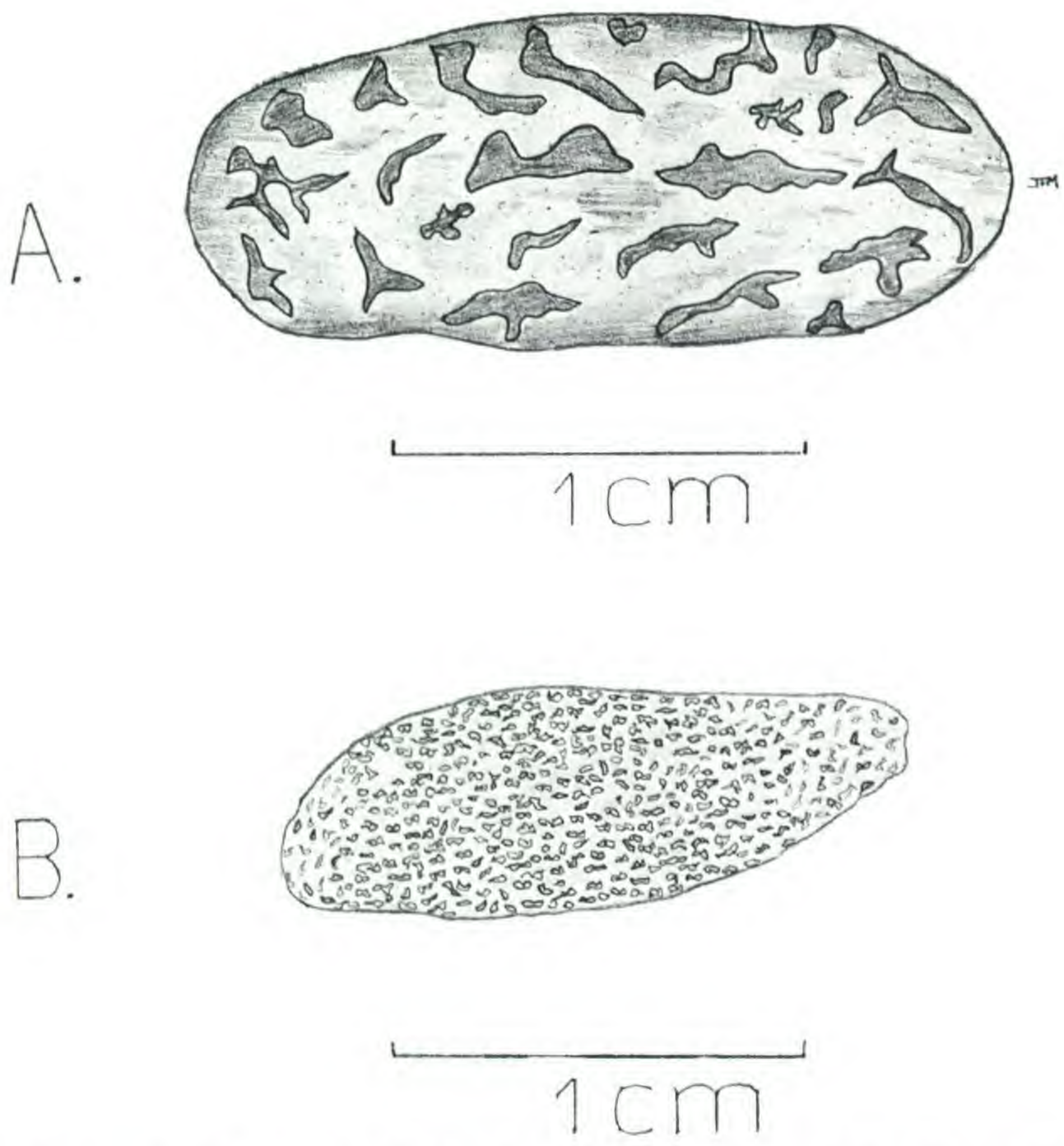

Figure 3. Seeds of *Macoubea*. —A. *M. sprucei* (Müller Argoviensis) Markgraf (*Revilla 3747*). —B. *M. mesoamericana* J. F. Morales (*Chacón 185*).

Alto Lari, *Aguilar et al. 938* (INB, MO); Parque Internacional La Amistad, Croriña, *Chacón 185* (INB, MO); Bratsi, Talamanca, *Herrera 3343* (COL, CR, F, INB, MO, NY, USJ). PANAMA. **Panamá:** along El Llano–Cartí road, *Correa et al. 1847* (DUKE, MO, PMA), *de Nevers et al. 4845* (MO), *de Nevers et al. 6219* (MO), *Gentry et al. 14198* (MO), *Kennedy 2411* (MO), *Kennedy 2518* (MO), *Liesner 1145a* (MO), *McPherson et al. 8201* (MO), *McPherson et al. 8216* (MO), *Mori et al. 5106* (MO). **San Blas:** El Llano–Cartí road, *Herrera et al. 1046* (MO), *de Nevers et al. 4347 (MO)*, *de Nevers et al. 5005 (MO)*, *de Nevers et al. 6193* (MO).

KEY TO THE SPECIES OF *MACOUBEA*

1a. Corolla lobes 1.1–1.6 cm long; fruits 1-carpellate by abortion, globose, subglobose, or subspherical . . . . . *M. guianensis* Aublet

1b. Corolla lobes 0.7–1 cm long; fruits hemisyncarpous, composed by two locules fused basally, locules somewhat rounded to reniform, sometimes reduced to only one locule by abortion but never subspherical or globose.

2a. Fruits 9–13 × 6–7.5 cm; seeds coarsely rugose, with conspicuous and irregular depressions along the testa; Amazonia . . . . . *M. sprucei* (Müller Argoviensis) Markgraf

2b. Fruits 4.5–6(–7) × 2.8–3.6 cm; seeds minutely and finely rugose, inconspicuously and minutely pitted; Costa Rica and Panama . . . . . *M. mesoamericana* J. F. Morales

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Rhodocalyx (Apocynaceae), a New Synonym of *Prestonia*

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ABSTRACT. The genus *Rhodocalyx* is reduced to synonymy under *Prestonia*. A new combination, *P. erecta*, is proposed here.

Prestonia R. Brown (Apocynaceae, Apocynoideae) is a neotropical genus of about 55 species. These lianas (rarely suffrutescent herbs) are characterized by having the corolla tube usually with a corona within (sometimes the free corona lobes are replaced by callus ridges), with a conspicuous annular corona (entire to five-lobed), clear latex, sepals with a single episepalous colleter (sometimes deeply lacerated), and truncate seeds (Woodson, 1936a; Morales, 1997a, 1997b). The genus was divided into four sections by Woodson (1936a), according to the presence or absence of the free corona lobes in the corolla tube, shape and length of the sepals, and the nature of the corolla indument. As explained by Woodson (1936a) and Morales (1997a), section *Tomentosae*, characterized by pubescent corollas, is taxonomically the most difficult section in the genus.

During studies toward a clarification of some nomenclatural problems in *Prestonia* (Morales, 1997a), it became evident that a re-evaluation of the characters traditionally used to delimit the genus, as well as an analysis of its relationships with some closely related genera, was needed in order to make the generic delimitation of the genus more natural and consistent. Recently, Morales (1997b) evaluated *Prestonia* sect. *Coalitae* and transferred three species to *Echites*, because they lacked both an annular corona and corona lobes within the corolla, the principal characters of *Prestonia*, thus maintaining both genera as natural groups.

According to the concepts of Woodson (1933, 1936a) and Pichón (1950), *Prestonia* is easily distinguished by having the corolla tube with a conspicuous annular corona, usually with five free epistaminal corona lobes within (but these sometimes absent or reduced to callus ridges), and a solitary episepalous colleter.

The two genera most closely related to *Prestonia* are *Laubertia* and *Rhodocalyx*, both of which also have a thickened annular corona in the mouth. *Laubertia* A. DC. is easily distinguished by the eglandular sepals lacking colleters within; careful study of this genus shows that *Laubertia* could simply be a *Prestonia* that lost its calycine colleters, but here it is considered to stand as a good genus. This character is very important to separate some genera of Apocynaceae (e.g., *Rhabdadenia*, *Elytropus*, *Cycladenia*) and therefore, despite the presence of a conspicuous faucal annulus, the eglandular sepals easily separate *Laubertia*.

Rhodocalyx Müller Argoviensis (1860) has traditionally been separated from *Prestonia* by its erect habit, terminal inflorescences, and corolla tube with a conspicuous annular corona in the mouth but lacking free corona lobes (Woodson, 1933; Pichón, 1950; Ezcurra, 1992). The need to evaluate these characters when considering the reduction of *Rhodocalyx* to synonymy of *Prestonia* was previously mentioned by Ezcurra (1992), who revealed the close affinity of these genera and the similarity of *R. rotundifolius* Müller Argoviensis to *P. riedelii* (Müller Argoviensis) Markgraf.

Recently, Stranghetti and Sumiko (1996) re-evaluated *Rhodocalyx* in a comparative morphological study with two species of *Mandevilla* and two species of *Prestonia* that are vegetatively and superficially (fide Stranghetti & Sumiko, 1996) somewhat similar to *Rhodocalyx*, which reflects basically the same work as Stranghetti (1992). Stranghetti and Sumiko concluded that *Rhodocalyx* must be conserved as a monotypic genus. However, in the process of preparing a synopsis of *Prestonia* and *Mandevilla*, and after the examination and evaluation of the critical morphological characters (habit, indument, leaves, inflorescences, sepals, corollas, and gynoecia) in most of the species of both genera, I have found important evidence which indicates that *Rhodocalyx* should be included in the synonymy of *Prestonia*. Explanation is in order.

I disagree with the relationships of *Rhodocalyx* with respect to *Mandevilla* suggested by Stranghetti and Sumiko (1996). As was shown previously, the most important characters separating *Prestonia* and the closely related *Laubertia* from the rest of the neotropical genera of Apocynaceae are the shape of the style head, attachment of the anthers to the

style head, and the annular corona in the orifice of the corolla tube. *Mandevilla* never has an annular corona; instead, one of the most important morphological features shared by *Mandevilla* and the closely related *Allomarkgrafia, Forsteronia* (subg. *Forsteronia* only), *Macrosiphonia, Mesechites, Quiotania,* and *Tintinnabularia* is the presence of colleters on the leaf midvein adaxially (Hansen, 1985; Morales, 1996, 1997c, 1997d; Zarucchi, 1991): the leaves of *Rhodocalyx* lack colleters adaxially on the leaf blade.

Rhodocalyx is restricted to the "campos" and savannas of central and southern Brazil and the Sierra de Amambay in northern Paraguay. Commonly, species of *Mandevilla* from this phytogeographic area have terminal to subterminal inflorescences and an erect habit, in contrast to the typically axillary inflorescences and scandent habit of the genus. Despite the anomalous morphologies of these species, all the rest of the characters fall well within the range of *Mandevilla.* This suggests that those character states (erect habit and terminal inflorescence) traditionally used to separate *Rhodocalyx* from *Prestonia,* and emphasized by Stranghetti and Sumiko (1996), are insignificant.

Terminal inflorescences, a character supposedly restricted to *Rhodocalyx,* are found in some species of *Prestonia.* At the time of Woodson's (1936a) monograph, all species of *Prestonia* then known were characterized by axillary inflorescences. Since then, additional species in section *Tomentosae* have been found with both axillary or terminal to subterminal inflorescences. For example, *Steyermark et al. 111114* (F, VEN, Z), *Prestonia parvifolia* Bentham from Venezuela, has terminal or subterminal inflorescences. In addition, some recently described species (e.g., *P. tysonii* A. H. Gentry) clearly have terminal inflorescences. Therefore, the distinction of the two genera based on this character seems unwarranted.

In addition to the annular corona of the corolla tube, another important feature on which *Rhodocalyx* was segregated from *Prestonia* is the corolla tube without free corona lobes, a character supposedly restricted to *Prestonia.* Although the presence of free corona lobes is characteristic of *Prestonia* and *Cycladenia* in the New World, in some species of *Prestonia* the corolla tube lacks free corona lobes behind the anthers or only has inconspicuous callus ridges. This is obvious in *P. dusenii* (Malme) Woodson, *P. riverae* J. F. Morales, *P. mexicana* A. DC., *P. hammelii* J. F. Morales, *P. speciosa* Donnell Smith, *P. clandestina* J. F. Morales, and *P. riedelii* (Müller Argoviensis) Markgraf. This is the situation in *Rhodocalyx,* which has conspicuous callus ridges within the corolla tube.

As to other characters used by Stranghetti and Sumiko (1996), leaf pubescence is highly variable among all the species of *Prestonia* sect. *Tomentosae* and *Rhodocalyx.* Therefore, this feature has little taxonomic value to separate *Prestonia* from *Rhodocalyx.* The differences in the corolla color are not always constant in *Prestonia*: in *P. mollis* Kunth corolla color varies from cream to cream-purple to greenish purple.

This inconsistency and the independent variation of the characters used to separate these genera suggest that it is necessary to relegate *Rhodocalyx* to the synonymy of *Prestonia.* This brings a measure of consistency to the generic classification, without which other well-defined genera, such as *Mandevilla,* could be subdivided based on the same kind of weak characters. *Rhodocalyx rotundifolius* Müller Argoviensis is thus transferred below to *Prestonia.* A new combination is proposed here.

Prestonia R. Brown, Mem. Wern. Soc. 1: 69. 1811. TYPE: *Prestonia tomentosa* R. Brown.

Haemadictyon Lindley, Trans. Hort. Soc. London 6: 70. 1826. TYPE: *Haemadictyon venosum* Lindley [= *Prestonia quinquangularis* (Jacquin) Sprengel].

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Belandra S. F. Blake, Contr. Gray Herb. 52: 78. 1917. TYPE: *Belandra concolor* S. F. Blake [= *Prestonia longifolia* (Sessé & Moçiño) J. F. Morales].

Prestonia erecta (Malme) J. F. Morales, comb. nov. Basionym: *Rhodocalyx erectus* Malme, Ark. Bot. 21 A (6): 15. 1927, nom. nov. for *Echites erecta* A. DC. *Echites erecta* A. DC., Prodr. 8: 469. 1844, non Thunberg, Gen. Echitis Observ.: 7. 1819; non Vellozo, Fl. Flumin. 113. 1829. *Rhodocalyx rotundifolius* Müller Argoviensis, in Mart. Fl. Bras. 6 (1): 173, pl. 51. 1860, nom. nov. for *Echites erecta* A. DC., non *Prestonia rotundifolia* K. Schumman ex Woodson, Ann. Missouri Bot. Gard. 23: 318. 1936. TYPE: Brazil: data lacking, *Claussen 343* (holotype, G-DC not seen; isotype, G; photo of holotype at INB).

Prestonia erecta flowers from late August to January, and fruits are borne from January to April. This species is commonly found in savannas and open areas. For excluded species, see Woodson (1936b).

Prestonia erecta J. F. Morales is closely related to *P. riedelii* (Muller Argoviensis) Markgraf but can

be distinguished by the erect habit, short-petiolate leaves, and terminal inflorescences of the former species.

Acknowledgements. I thank the curators and directors of F, G, G-DC, VEN, and Z for the loan of material. I thank Michael Grayum for critical comments on the manuscript.

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A New Species of *Lilaeopsis* (Apiaceae) from Mauritius

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ABSTRACT. A new species of *Lilaeopsis*, *L. mauritiana*, is described and illustrated. The species is endemic to Mauritius (southwest Indian Ocean), where it has been found at a single locality in Le Val Nature Park. The predominantly temperate and alpine genus *Lilaeopsis* has not previously been recognized from Mauritius.

Lilaeopsis E. L. Greene (Apiaceae) consists of small, perennial, rhizomatous herbs occupying moist or truly aquatic habitats. Five species occur in North America, six in South America (including two North American disjuncts), two in Australia, and two in New Zealand. An unidentified species has been reported from Kerguelen Island in the South Indian Ocean, but a possible occurrence of *Lilaeopsis* on Madagascar (Raynal, 1977) is considered dubious (Affolter, 1985: 34). In the treatment of the Apiaceae for the *Flore des Mascareignes* (Scott, 1990), *Lilaeopsis* is not included.

The species of *Lilaeopsis* are morphologically difficult to distinguish due to their much reduced vegetative habit and relatively simple, uniform inflorescences. The leaves are linear to spathulate, hollow, and transversely septate. They are assumed to consist of only the axis of the compound leaves common to most Apiaceae species. Mainly morphological and anatomical characters of the fruit have been applied to distinguish species (Affolter, 1985).

Lilaeopsis mauritiana G. Petersen & Affolter, sp. nov. TYPE: Cult. from Mauritius, Le Val Nature Park near Le Val, 20°21′S, 57°37′E, 5 Mar. 1992, *H. Windeløv s.n.* (holotype, C; isotypes, GA, UC). Figures 1, 2.

Note. All types are cultivated specimens derived through vegetative propagation of the original collection; 5 Mar. 1992 is the collection date.

Differt a aliis speciebus *Lilaeopsidis* fructibus costis conspicuis, tenuibus, obtusis, sed sine cellulis spongiosis et sine cellulis pusillis, incrassatis, lignosis, ornatis.

Glabrous, perennial herbs with creeping rhizomes. Rhizomes 0.5–1.2 mm diam. Leaves arise individually or in 2–3(–4)-leaved clusters directly from horizontal rhizomes, hollow and terete to elliptical in cross section proximally, becoming flattened and solid in cross section distally, linear to subulate, 2.8–13.0 cm long, 0.4–1.3 mm broad, 4–9 septate, attenuate at apex, expanded at base into a scarious sheath, 0.1–0.5 cm long. Peduncles 6–26 mm long, borne directly at nodes on the horizontal rhizome, subtended by a short bract 0.9–1.2 mm long, sometimes opposite a leaf. Involucral bracts 0.4–2.0 mm long. Umbels 3–6-flowered; pedicels 0.9–6.0 mm long. Petals greenish white. Fruits globose to ellipsoid or obovoid, 1.9–2.5 mm long, 1.7–2.0 mm broad, spongy cells absent from all ribs; dorsal and intermediate ribs prominent and narrowly rounded, lateral ribs broadly rounded; vittae 6–8, 2–3 on the commissure. Chromosome number $2n = 22$. Figures 1, 2.

The phylogeny of *Lilaeopsis*, which included 13 species in the monograph by Affolter (1985), is completely unknown. Hence, it is difficult to determine whether the closest relatives to *L. mauritiana* should be found among the New World or Australasian species.

Two important characters for separating many species of *Lilaeopsis* are the abundance and distribution of "spongy cells" in the fruit. These are storage tracheids, nearly isodiametric in shape, that lack a living protoplast at maturity. In cross sections of fresh, green fruits they are visible to the naked eye as bright white patches; under microscopic examination the spongy cells display characteristic secondary wall thickenings. They appear to enhance dispersal in *Lilaeopsis* by increasing the buoyancy of the fruits.

Spongy cells are completely absent from the fruits of *L. mauritiana* (Fig. 2). This character has been observed in only three other species of the

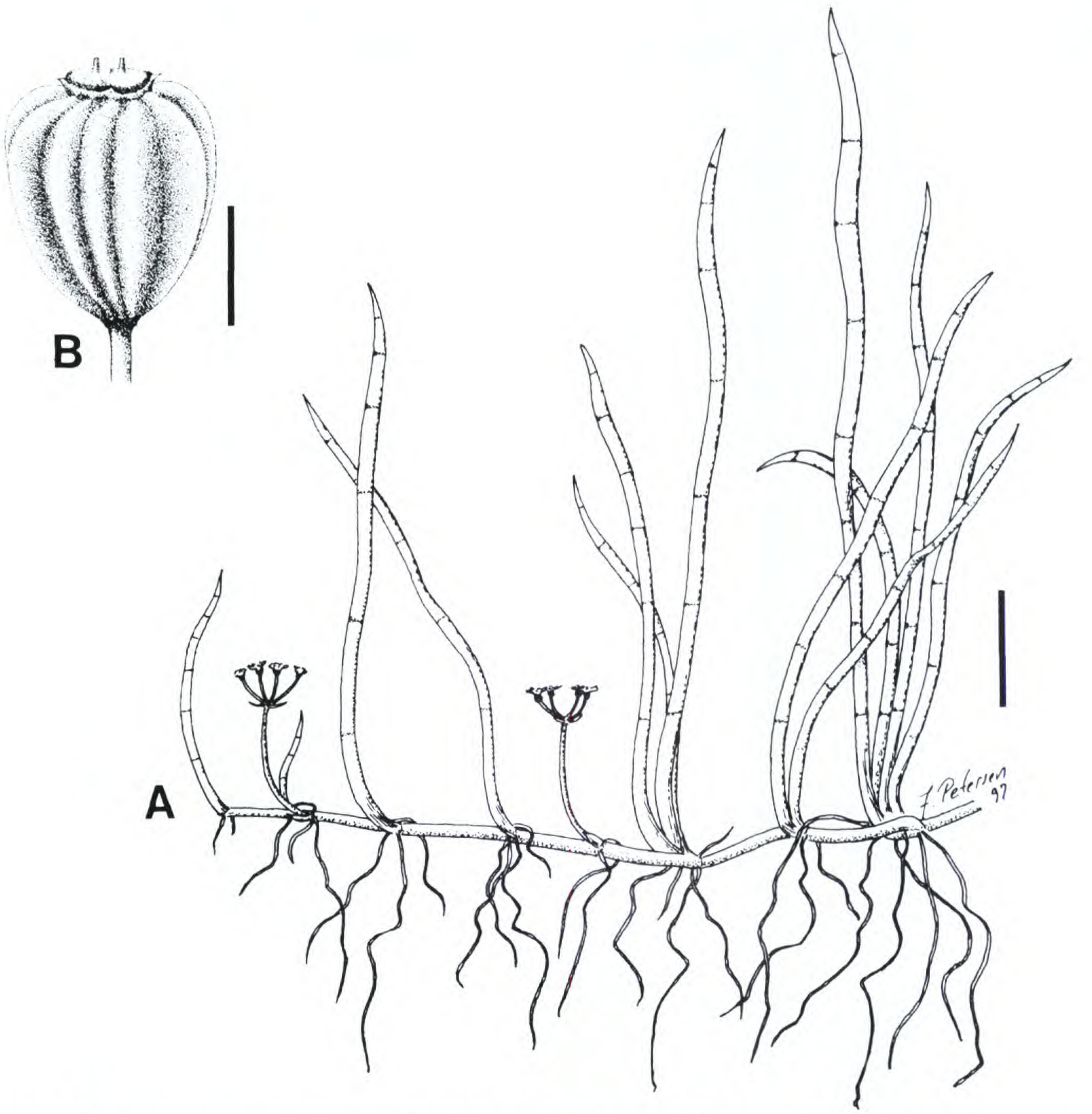

Figure 1. *Lilaeopsis mauritiana* G. Petersen & Affolter. —A. Habit. —B. Fruit. Scale bars: A = 1 cm, B = 1 mm. (Based on *H. Windeløv s.n.*)

genus. Fruits of the widespread and highly variable *L. macloviana* (Gandoger) A. W. Hill from South America sometimes lack spongy cells, but unlike *L. mauritiana* the lateral ribs are then low and obscure rather than broadly rounded. Another variable species, *L. polyantha* (Gandoger) H. J. Eichler from Australia, also occasionally produces fruits without spongy cells, but in that case the fruits possess distinctive thick-walled lignified cells that are not present in the fruits of *L. mauritiana*. Finally, fruits of *L. ruthiana* Affolter, from New Zealand, often lack spongy cells, but all the fruit ribs are low and obscure—much less prominent than those of *L. mauritiana*.

Further studies are clearly needed to produce a phylogenetic hypothesis for *Lilaeopsis*. As morphological characters are scarce and variable, molecular data may prove most helpful.

Distribution and habitat. *Lilaeopsis mauritiana* has only been collected at a single locality in Le Val Nature Park near Le Val in the southeast part of the island of Mauritius. The habitat, located at an altitude of approximately 300–500 m, is a moderately flowing, clear-watered stream, along which the plants were found growing both fully submerged and on the drier part of the bank.

The flora of Mauritius is characterized both by a large number of introduced species and by a large number of endemics (Baker, 1877; Vaughan, 1937; Vidal, 1988). The locality occupied by *L. mauritiana* is a popular recreation area, and in the stream it was found growing together with *Aponogeton*

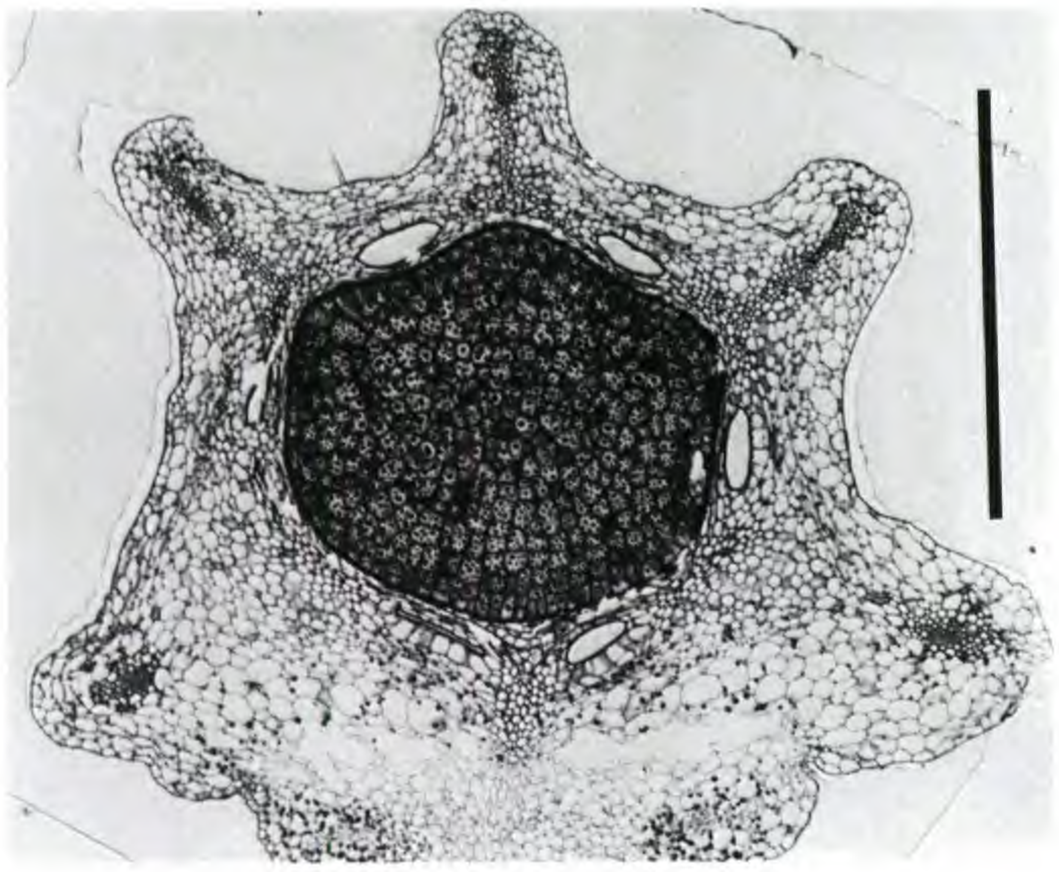

Figure 2. *Lilaeopsis mauritiana (H. Windeløv s.n.).* Transverse section of mature fruit embedded in GMA and stained in PAS-ABB. Scale bar = 0.5 mm.

madagascariensis H. Bruggen. *Aponogeton madagascariensis* is usually recognized as a Madagascan endemic introduced to Le Val, Mauritius, in the mid 1850s (H. W. E. van Bruggen, pers. comm.; Vaughan, 1937, under the synonym *A. fenestralis* J. D. Hooker). The possibility exists that *Lilaeopsis mauritiana* has been introduced to Mauritius, but as the species is clearly distinct from all other described species it must be considered endemic to the island until proven otherwise. With the discovery of *Lilaeopsis mauritiana* on Mauritius, the postulated occurrence of a species of *Lilaeopsis* on Madagascar (Raynal, 1977) merits further attention.

Acknowledgments. We thank Kate Jensen, Lisbeth Knudsen, Jimmy Olsen, and Flemming Sarup for skillful technical assistance. Jan Petersen made the line drawings, and Peter Wagner kindly prepared the Latin diagnosis. We owe special thanks to Claus Christensen for placing the new species at our disposal.

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Maytenus rupestris (Celastraceae), a New Species from Minas Gerais, Southeastern Brazil

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ABSTRACT. *Maytenus rupestris* Pirani & Carvalho-Okano, a new species of Celastraceae endemic to the Serra do Cipó, Minas Gerais, Brazil, is described and illustrated. Included in section *Maytenus*, it is distinct from its congeners (especially from *M. boaria* Molina) by its ascending, very narrow leaves with revolute margins that are entire or sparsely denticulate on the distal half, and by its few-flowered cymes.

Maytenus Molina emend. Molina is one of the largest genera in the Celastraceae, with around 200 pantropical species, mostly South American (Bornstein, 1989). According to Carvalho-Okano (1992), 77 species occur in Brazil, from Amazonia to the south of the country. In the state of Minas Gerais, 14 species occur, 10 belonging to section *Maytenus* (*M. evonymoidis* Reissek, *M. floribunda* Reissek, *M. glazioviana* Loesener, *M. gonoclada* Martius, *M. imbricata* Reissek, *M. ligustrina* Reissek, *M. radlkoferiana* Loesener, *M. robusta* Reissek, *M. salicifolia* Reissek, and *M. urbaniana* Loesener), and 4 to section *Oxyphylla* Loesener (*M. acanthophylla* Reissek, *M. aquifolia* Martius, *M. comocladiaeformis* Reissek, and *M. rigida* Martius).

While performing floristic surveys along the mountains of the Espinhaço Range, in Minas Gerais and Bahia, a new species was found in river margins in the Serra do Cipó and is presented here. (Note: the acronym CFSC = Coleção Flora da Serra do Cipó.)

Maytenus rupestris Pirani & Carvalho-Okano, sp. nov. TYPE: Brazil. Minas Gerais: Município de Santana do Riacho, Serra do Cipó, Ribeirão Indequicé, Cachoeira do Cornélio, perto da Estrada da Usina, 5 Oct. 1981 (fl), *A. Furlan, I. Cordeiro, M. L. Kawasaki & J. R. Pirani CFSC 7506* (holotype, SPF; isotypes, K, NY, RB, SP, VIC). Figure 1.

Ab omnibus congeneribus foliis anguste oblongo-ellipticis margine revoluto integerrimo vel ultra medium remote denticulato, cymis brevibus paucifloribus differt.

Shrub or small tree, 1–3 m tall, glabrous. Twigs grayish, 4-angled. Leaves alternate, ascending, narrowly oblong-elliptic, apex obtuse or sometimes acute or truncate, often mucronulate, base attenuate and decurrent to the short petiole, margin entire or rarely with 2 very small teeth on the distal part, revolute, in vivo dark green and lustrous on the adaxial face, light green and dull on the abaxial face, in sicco grayish to glaucous on both faces or slightly ochraceous on the abaxial face, 30–80 mm long, 4–8 mm wide; primary vein prominent on both faces at least toward base, venation brochidodromous, secondary veins straight to slightly curved, evident on the abaxial face, obscure on the adaxial face. Stipules 7–10 mm long, triangular, blackish. Inflorescence a reduced cyme with 2–3(–4) flowers, axillary, pedunculate, ramified, 6–14 mm long; bracts triangular, 5–7 mm long, apex acute to acuminate, margin irregularly serrulate. Flowers 5-merous, short-pedicellate, cream to greenish colored; sepals ovate, ca. 1 mm long; petals free, oblong, apex rounded, ca. 3 mm long, margin thin and slightly undulate, reflexed at anthesis; stamens 5, alternate with the petals, ca. 2 mm long, filaments flattened, attenuate to the apex, broadened toward base, inserted on the base of the intrastaminal disc, reflexed at anthesis, anthers ovoid, yellow; intrastaminal disc fleshy, 5-lobed, ca. 2 mm diam., margin undulate; gynoecium of 2 fused carpels, the base of the ovary slightly fused to the disc, stigma 2-lobed on a short style. Fruit a loculicidal capsule, ellipsoid to obovoid, apiculate, ca. 10 mm long, ca. 7 mm diam., yellow to orange when ripe, opening in 2 reflexed valves consisting of 2 halves of adjoining carpels; seed 1, erect, completely surrounded by a white, soft aril.

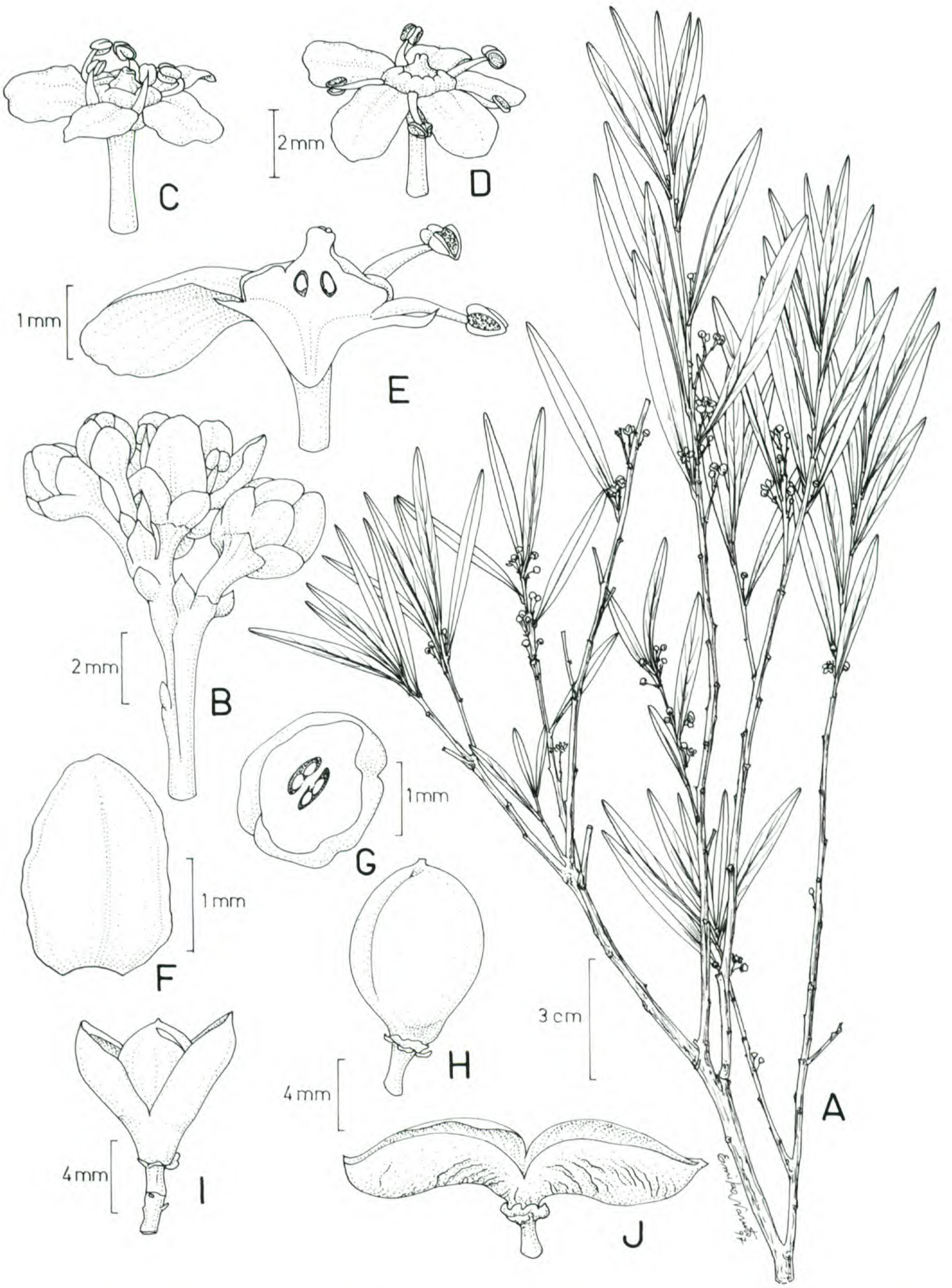

Figure 1. *Maytenus rupestris* Pirani & Carvalho-Okano. —A. Flowering shoot; note 4-angled twigs. —B. Cyme with 4 flowers. —C. Flower at anthesis, before dehiscence of the anthers. —D. Flower with the stamens reflexed and anthers opened. —E. Longitudinal section of a flower. —F. Petal, adaxial view. —G. Cross section of an ovary. —H. Fruit before dehiscence. —I. Capsule opened showing seed surrounded by an aril. —J. Capsule after dropping of the seed, with reflexed valves. A, C–G, drawn from *Furlan et al. CFSC 7506*; B, drawn from *Joly CFSC 3691*; H–J, drawn from *Pirani CFSC 11449*.

Maytenus rupestris is distinct from the other species of the genus by its ascending, very narrow leaves, with revolute margins, commonly entire but sometimes with small teeth on the distal part, and also by its few-flowered (2–3, seldom 4), reduced cymes. Besides this combination of characters, *M. rupestris* is easily recognized in the field by the color of its leaves, which are dark green and shiny above and light green and dull below, turning grayish to glaucous on both faces when dried, probably because of the presence of an epicuticular wax layer.

Maytenus rupestris is included in section *Maytenus*, along with the bulk of the taxa in the genus, because of its entire (vs. spiny) leaf margins. *Maytenus boaria* Molina, from southern Brazil, Argentina, Chile, and Peru, also has very narrow leaves, but it seems not to be closely related to the new species, since its leaves have glandular-serrate, not revolute margins, its stipules are linear, fimbriate, and its inflorescences are multi-flowered fascicles.

Maytenus rupestris is known so far only from the Serra do Cipó, in the southern part of the Espinhaço mountain range, in the state of Minas Gerais. It is a shrub or much-branched tree up to 3 m that grows as a heliophyte in open vegetation among sandstone rocks ("campo rupestre"), by the river and sides of gullies of that region. It occurs sometimes close to riparian forests, but not in the shadow of the tree canopies. Although it is probably endemic to the Serra do Cipó, since it has not been found elsewhere so far, locally it is relatively common. The flora of the "serras" of the Espinhaço Range shows a high number of endemic species, and even endemic genera, in several families, but mostly referring to taxa from open formations (Giulietti et al., 1997). However, in many instances, even essentially forest genera (like the case of *Maytenus*) happen to show one or a couple of endemic "campo rupestre" members in the Espinhaço.

Paratypes. BRAZIL. **Minas Gerais:** Santana do Riacho, Serra do Cipó, Rodovia Belo Horizonte-Conceição do Mato Dentro, km 128, 4 Nov. 1972 (fl), *A. B. Joly CFSC 3691* (SP, SPF, VIC); km 129, 20 Oct. 1973 (fl), *A. B. Joly et al. CFSC 4607* (FCAB, SP); km 117, 4 Sep. 1973 (fl), *J. Semir et al. CFSC 4381* (SP); km 117, 26 July 1973 (fr), *N. L. Menezes CFSC 4293* (SP); Estrada da Usina Dr. Pacífico Mascarenhas, 14 Nov. 1983 (fl, fr), *J. R. Pirani & L. Rossi CFSC 9215* (SPF, VIC); 2 km acima da entrada para a Estrada da Usina, 6 Sep. 1987 (fl), *R. Simão CFSC 10427* (SPF); km 111, Vale do Córrego Vitalino, 20 May 1989 (fr), *J. R. Pirani CFSC 11449* (MBM, SP, SPF, VIC).

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A New Species of *Miconia* (Melastomataceae) from Serra da Canastra National Park, Minas Gerais, Brazil

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ABSTRACT. A new species of the genus *Miconia* sect. *Cremanium* from highland "campo rupestre" vegetation of the Serra da Canastra National Park, São Roque de Minas, is described and illustrated. It is distinguished from other species in this section by the 4-celled ovary with glabrous apex and leaves lanate below.

This new species of *Miconia* was discovered during a floristic survey carried out by the Herbarium Uberlandense (HUFU) from the Universidade Federal of Uberlândia in the Serra da Canastra National Park, southwestern Minas Gerais state.

Miconia angelana R. Romero & R. Goldenberg, sp. nov. TYPE: Brazil. Minas Gerais: São Roque de Minas, Parque Nacional da Serra da Canastra, vale da nascente do rio São Francisco, lado das matas, beira do córrego, 1100 m, 46°15′–47°00′W, 20°00′–20°30′S, 20 Nov. 1996, *R. Romero & J. N. Nakajima 3773* (holotype, HUFU; isotypes, K, MO, RB, UEC, US). Figures 1–5.

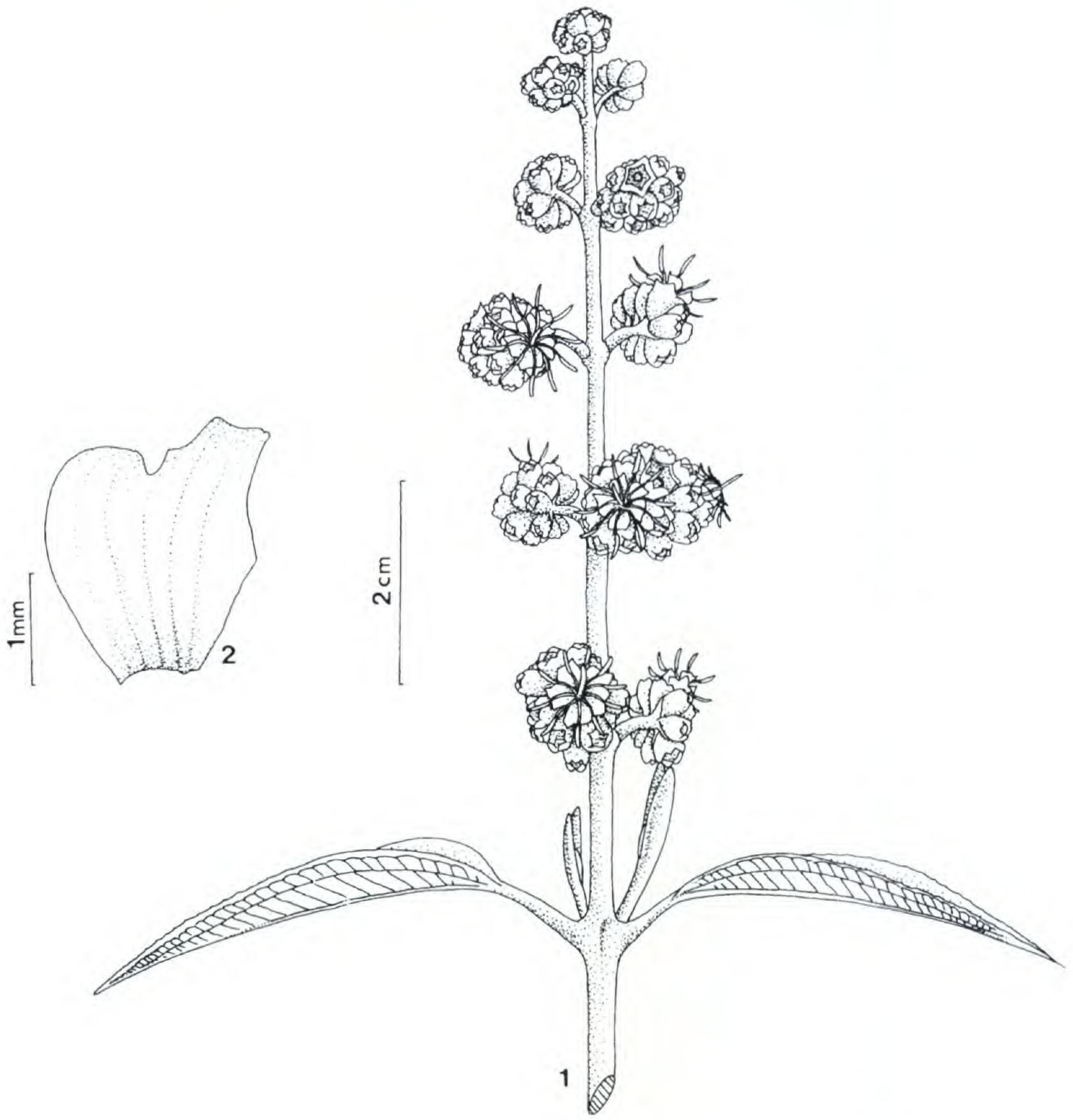
Arbor parva ca. 2 m. Lamina oblongo-lanceolata, apice acuto vel acuminato, basi rotundata, margine remote undulato-denticulato, subtus dense lanato. Panicula elongata; flores 5-meri, sessiles, ramis inflorescentiae in glomerulo denso verticillato-congestis. Antherae oblongae vel cuneatae, ad apicem truncatae, 2-porosae. Ovarium 4-loculare, apice glabro.

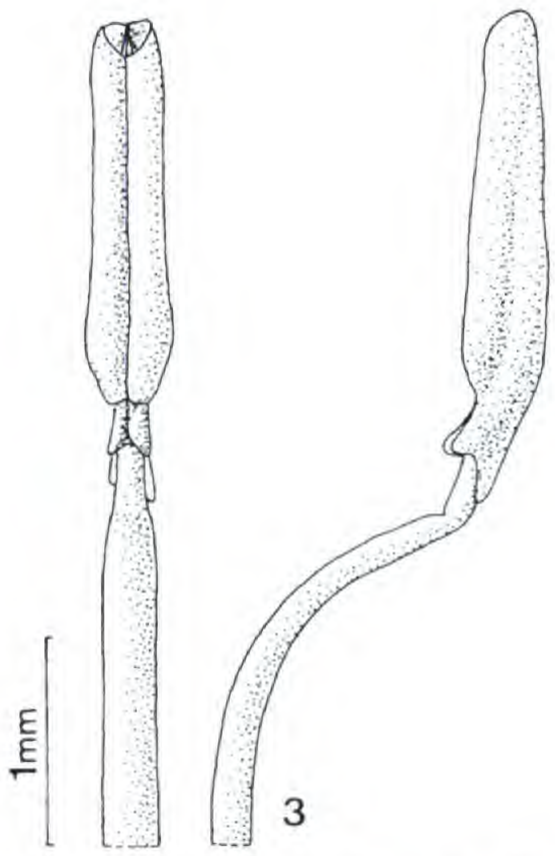
Small tree, ca. 2 m tall, the stem, branches, petioles, lower leaf surface, inflorescence, and hypanthium densely covered with dendritic hairs with long and slender arms, canescent to yellowish brown; young branches slightly flattened, older branches terete and striate. Petioles 1.2–2.2 cm long, striate; leaf blade 5.5–14.0 × 1.5–4.0 cm, oblong-lanceolate, apex acute to shortly acuminate, base narrowly rounded, margin slightly and remotely denticulate, hyaline, above covered with dendritic hairs, soon becoming glabrous, 3-nerved, with an additional tenuous marginal pair, below with the primaries, secondaries, and transverse veins prominent, impressed above. Panicle 7.5–13.5 cm long, the sessile, 5-merous flowers capitate-congested on very short lateral branchlets; bracts 0.6–1.0 cm long, linear, bracteoles 3.0–3.5 mm long, linear, persistent. Hypanthium 2.3–3.0 × 2.5–3.3 mm, campanulate. Calyx lobes 0.8–1.4 mm long, triangular, apex acute to rounded, external teeth inconspicuous and hidden by the indument. Petals 2.0–2.5 × 1.8–2.0 mm, obovate, apex retuse and asymmetrical, margins and abaxial side papillose. Stamens 10, subisomorphic; filaments 2.0–2.3 mm long, geniculate, glabrous; connective dorsally thickened and prolonged 0.3–0.6 mm below the thecae, with two ventral short lobes and one dorsal short spur; anthers 1.3–1.6 mm long, oblong to cuneate with truncate apex, biporose. Ovary 1.2 mm long, lower half adherent to the hypanthium, 4-locular, apex elongated, papillose, glabrous, 2–3 ovules per locule; style 3.5–4.0 mm long, filiform, glabrous, stigma truncate. Berry 2.5–3.0 × 3.0–3.5 mm, globose, blackish, surface smooth and glabrescent. Seeds 1.2–1.7 mm long, 10–15 per fruit, narrowly to broadly ovoid, surface smooth.

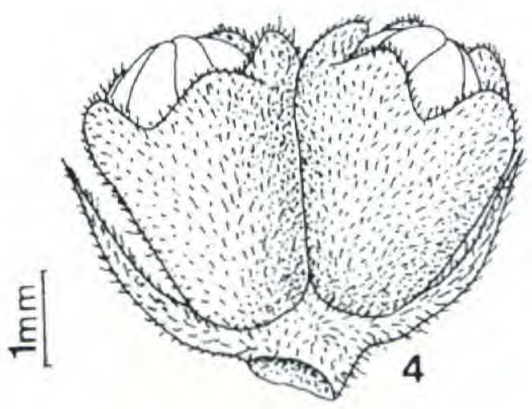
This species grows on the margins of small rivers in rocky soil of the highlands of the Rio São Francisco headwaters; it was collected with flowers in November, with fruits in December.

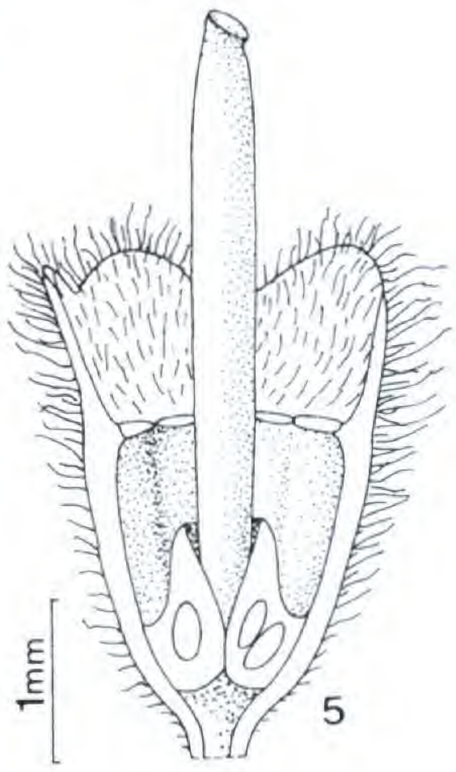
The section *Cremanium* Bentham & Hooker, which has eight species in Brazil, occurs mainly in the southeastern region. The new species is placed in this section based on the presence of cuneate and biporose anthers (Cogniaux, 1891). The 4-celled ovary with glabrous apex, seeds 1–1.7 mm long, and leaves lanate below distinguish *M. angelana* from *M. hyemalis* A. St. Hilaire & Naudin ex Naudin, to which it is certainly most closely related. The latter differs in having a 3-celled ovary with a stellate puberulent apex, longer seeds (2–2.6 mm), and leaves stellulate-tomentose below. *Miconia angelana* also resembles *M. lymanii* Wurdack, endemic to Santa Catarina (Wurdack, 1962), which has a 3-celled ovary with puberulous apex and leaves stellulate-furfuraceous below.

The specific epithet was chosen in honor of An-









Figures 1–5. *Miconia angelana* R. Romero & R. Goldenberg. —1. Flowering branch. —2. Petal. —3. Frontal and lateral views of stamen. —4. Buds. —5. Longitudinal section of flower to show ovary and the insertion of style, petals removed. Drawn from the holotype.

gela Borges Martins, for her important work on Brazilian Melastomataceae.

Paratypes. BRAZIL. **Minas Gerais:** São Roque de Minas, Parque Nacional da Serra da Canastra, nascente do Rio São Francisco, borda do córrego, 19 Nov. 1995, *J. N. Nakajima et al. 1509* (BHCB, HUFU, MO, UEC); nascente do rio São Francisco, beira de uma vertente, 20 Nov. 1996, *R. Romero & J. N. Nakajima 3783* (HUFU, VIC); vale do rio São Francisco, campo úmido dois meses após queimada, 7 Dec. 1994, *J. N. Nakajima & R. Romero 694* (HUFU, SP, US).

Acknowledgments. The first author is grateful to John J. Wurdack for helpful comments about this species, to the Smithsonian Institution for a research grant to study the collections in the United States National Herbarium, the Universidade Federal de Uberlândia for the facilities of the Herbarium Uberlandense (HUFU), the Instituto Brasileiro do Meio Ambiente (IBAMA) for the permission to collect at Serra da Canastra National Park, and CNPq for a research grant. The authors thank Eduardo Kickhöfel for preparing the illustration.

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Pycnostachys recurvata (Lamiaceae), a New Species from Ethiopia

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ABSTRACT. *Pycnostachys recurvata*, a new species from Ethiopia, is described and illustrated. Comparisons are made to *P. pseudospeciosa* and *P. chevalieri*, which it resembles by having recurved leaves, and to *P. niamniamensis*, *P. reticulata*, and *P. deflexifolia*, which it resembles in calyx shape.

Pycnostachys is a distinct genus belonging to Lamiaceae subfamily Nepetoideae tribe Ocimeae subtribe Plectranthinae. It is characterized by having dense, head- to spike-like inflorescences and subequally spiny-lobed calyces with scales between the lobes. According to Bruce (1939), who revised the genus, there are 37 species, all in tropical to southern Africa and on Madagascar. According to Cufodontis (1963), the east African *P. deflexifolia* Baker occurs in Ethiopia. However, the Ethiopian material distributed under this name and under *P. reticulata* (E. Meyer) Bentham has been found to represent a distinct taxon, which here is described as a new species. Material from the herbaria C, ETH, K, UPS, and WAG has been studied.

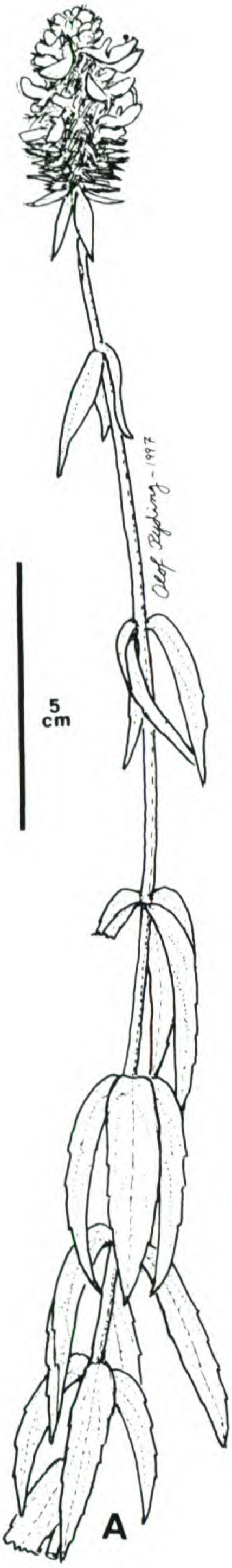
Pycnostachys recurvata Ryding, sp. nov. TYPE: Ethiopia. Shewa Region: about 60 km W of Ambo along "Lekemti" (Nekemte) road, ca. 1800 m, 10 Nov. 1965, *W. J. J. O. de Wilde & B. E. E. de Wilde-Duyfjes 8754* (holotype, C; isotypes, ETH, K, UPS, WAG). Figure 1A–C.

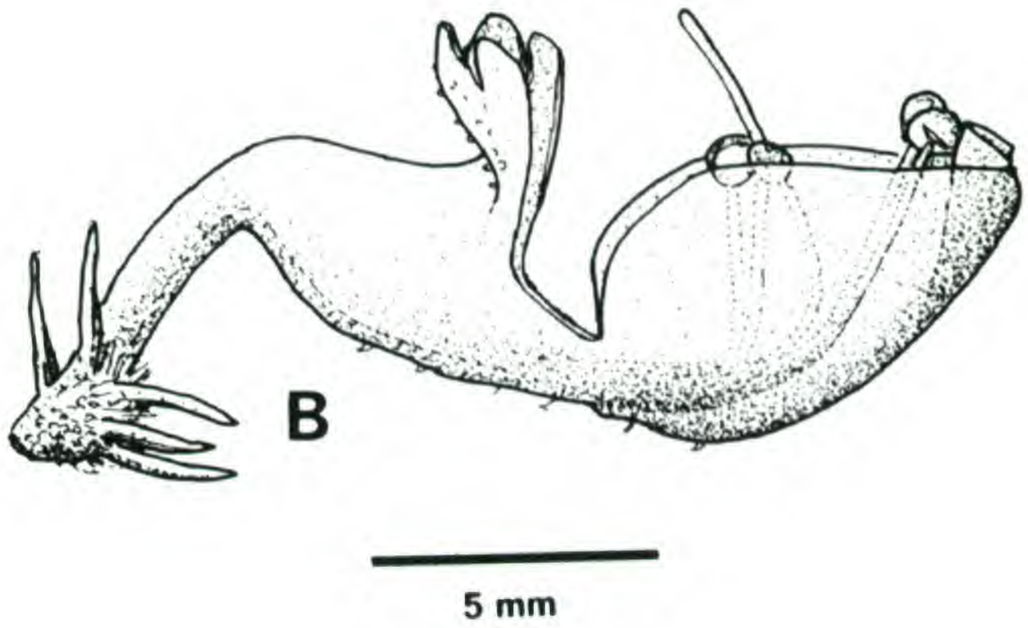
Differt ab aliis speciebus cognatis *Pycnostachyis* combinatione constanti ex herba perenni, foliis sessilibus recurvis basi rotundato, tubo calycis fructicantis sursum curvato, leviter constricto, lobis calycis moderate pubescentibus, 3–4.5 mm longis.

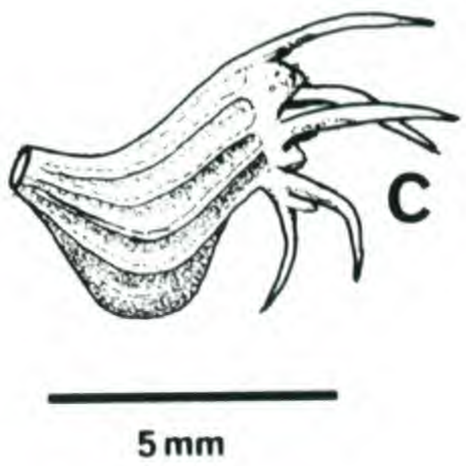
Perennial *herb*, 0.6–1.6 m tall. *Stems* hexangular or quadrangular, ± furrowed, rather densely pubescent with up to 0.2–0.5-mm-long recurved to spreading eglandular hairs and with sessile glands, in older parts more sparsely pubescent. *Leaves* ternate and/or sometimes decussate, mostly smaller on the flowering shoots than on the main stem, sessile, gradually recurved, lanceolate, ovate or elliptic, up to 20–60 × 8–28 mm, 1.6–5 times as long as broad, rather densely pubescent with short eglandular hairs below on the veins, otherwise sparsely pubescent and ± densely glandular with sessile glands, apex subacute or acute, base rounded, margin serrate. *Inflorescence* terminal on branches, dense, initially head-like, becoming elongate and spike-like in the fruiting stage, sometimes with a few spaced three-flowered whorls at the base, up to 30–70 mm long; bracts narrowly lanceolate-linear, up to 5–7 × 0.6–1.0 mm, recurved. *Flowers* sessile. *Calyx* enlarging up to a length of 6.5–8 mm in the fruit, with 5 erect triangular-acute scales alternating with and forming a whorl near inside the lobes; tube bent upward in the proximal half, slightly narrowed along the distal half, mostly slightly recurved near the mouth, with 10 slightly prominent longitudinal veins and a thicker vein at the throat, with sessile glands and hairy at least in the apical part, moderately hairy with eglandular hairs at the throat; lobes 5, narrowly linear-lanceolate, with a thick mid-rib terminating as a subulate apex, ± deflexed, 3–4.5 mm long in fruiting stage, moderately pubescent with short hairs. *Corolla* 2-lipped, 10–17 mm long, light to dark blue; tube narrow and tubular at the base, strongly bent near the middle, abruptly widening from the bend up to the throat, 4–8 mm long, ventral side 1–2 mm longer than dorsal side; upper lip 4-lobed, side-lobes narrower than mid-lobes; lower lip much longer than upper lip, 4–8 mm long, deeply boat-shaped, with the apex arched and pointing upward. *Stamens* 4, all connate along 1.5–2 mm; posterior pair shorter than the lower lip of the corolla, strongly bent upward; anterior pair as long as or slightly longer than lower lip of corolla; anthers rather deeply cup-shaped, 0.6–0.8 mm long; pollen-mass yellow. *Style* strongly upcurved, becoming slightly longer than the lower lip of the corolla, minutely bifid at apex. *Disc* with a ca. 1-mm-long abaxial lobe that is longer than the ovary and hides the two abaxial ovary lobes. *Nutlets* 1.4–1.7 × 1.0–1.2 mm, smooth, slightly glossy, brown, apparently not mucilaginous.

Distribution and habitat. Wet grasslands and swamps, in areas with an annual rainfall of 800–1600 mm; altitude 1200–2000 m. Flowering mostly from October to December (or March). Southwestern and southern Ethiopia (Fig. 1D).

The sessile, rather narrow leaves and the perennial habit suggest that *P. recurvata* belongs to the







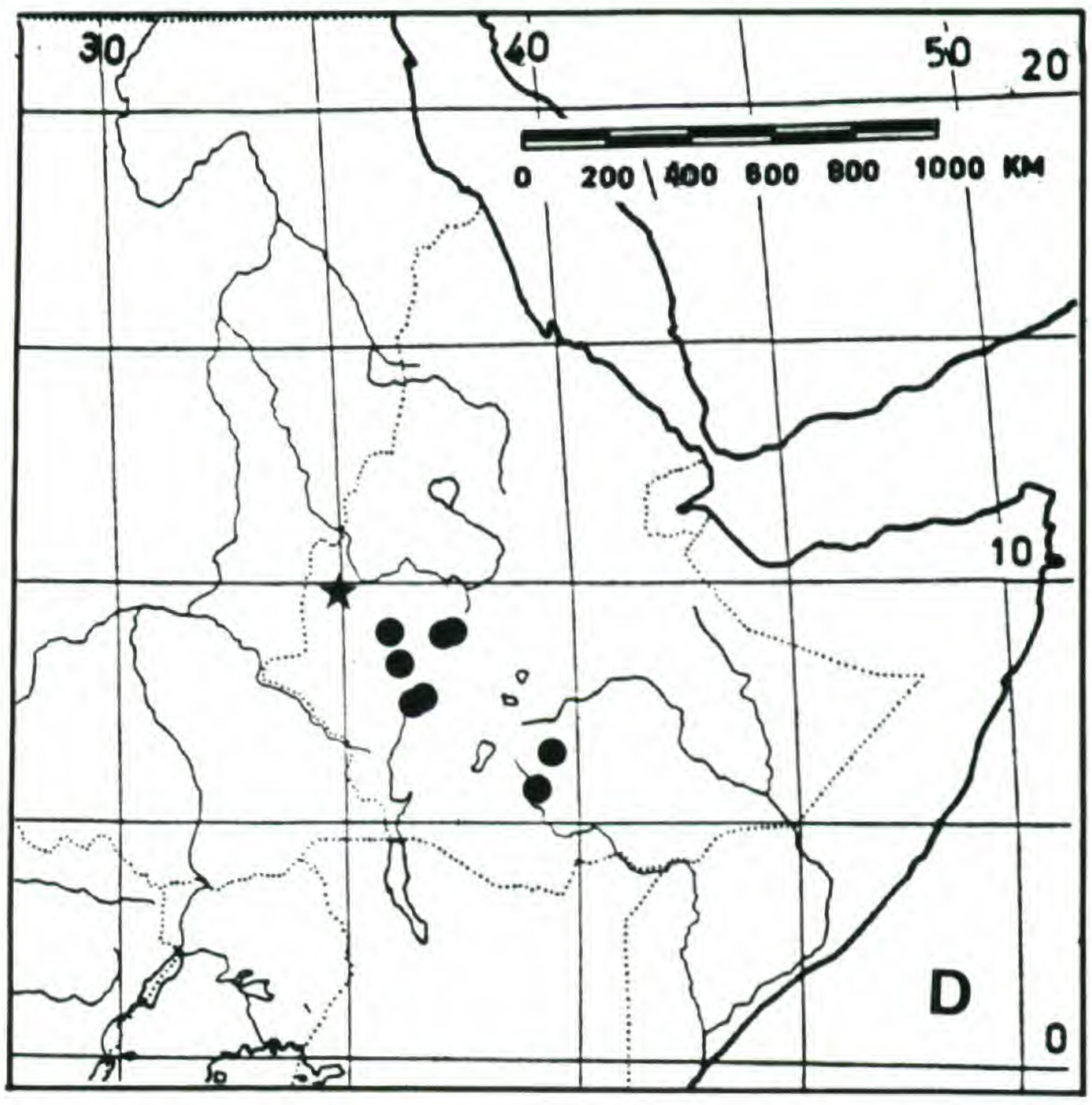


Figure 1. A–C. *Pycnostachys recurvata* Ryding. —A. Branch with inflorescence. —B. Flower. —C. Fruiting calyx. —D. Map of Ethiopia showing the known distribution of *P. recurvata* (dots) and the divergent Ethiopian form of *P. niamniamensis* (star). A drawn from *Mooney 8469* (K); B drawn from *de Wilde & de Wilde-Duyfjes 8754* (C); C drawn from *Mooney 8611* (K).

first, third, or fourth group in Bruce's (1939) infrageneric division of *Pycnostachys*.

Pycnostachys recurvata differs from most of the other species of *Pycnostachys* by having recurved leaves. *Pycnostachys pseudospeciosa* Buscalioni & Muschler from Zambia and Zaire usually resembles *P. recurvata* by having more or less recurved leaves (Buscalioni & Muschler, 1913: fig. on p. 259). However, *P. pseudospeciosa* differs from *P. recurvata* in some other respects, mainly in the shape of the fruiting calyx. Unlike that of *P. recurvata*, the fruiting calyx of *P. pseudospeciosa* is gradually and only slightly upcurved, gradually broadened toward the throat, very broad at the throat, and strongly hairy at the base of the lobes. *Pycnostachys chevaileri* Briquet from Chad also has recurved leaves, but this species differs from *P. recurvata* by having a cuneate leaf-base, and narrower, ca. 7-mm-long calyx lobes, and tending to have smaller (ca. 10 mm long) flowers. Several *Pycnostachys* species, such as *P. niamniamensis* Gürke, *P. reticulata* (E. Meyer) Bentham, and *P. deflexifolia* Baker, resemble *P. recurvata* in the shape of the fruiting calyx. In herbaria, the latter two names have often been used for material of *P. recurvata*. *Pycnostachys niamniamensis* from Sudan and east Africa, including a rather divergent form from western Ethiopia (represented by the collection *Mesfin & Kagnew 2269*), differs from *P. recurvata* by having erect and straight leaves, narrower, 5–8-mm-long calyx lobes, and more spreading calyx scales, and by tending to get longer spikes in the fruiting stage. *Pycnostachys reticulata* from southern Africa and south tropical Africa differs from *P. recurvata* by having straight and erect leaves that are cuneate rather than rounded at the base. Its calyx lobes tend to be more subulate than those of *P. recurvata*. *Pycnostachys deflexifolia* from east Africa has straight but deflexed leaves that are cuneate at the base. This species also differs from *P. recurvata* by having mostly smaller (ca. 8 mm long) flowers and longer (4–10 mm long) calyx lobes.

The two collections from Shewa differ from other material of *P. recurvata* by having slightly larger flowers.

Paratypes. ETHIOPIA. **Welega Region:** Barri (9°2′N, 36°10′E), 26 Mar. 1958, *Smeds 1275* (K). **Shewa Region:** 185 km from Addis Abeba on Lekemti road (8°58′N, 37°30′E), 3 Nov. 1962, *Mooney 10035* (ETH). **Ilubabor Region:** Buno Bedele Awraja, ca. 6 km E of Chora town, 21 Nov. 1981, *Mesfin T. & Kagnew G. Y. 2444* (ETH, K). **Kefa Region:** near Sombo (7°33′N, 36°37′E), 13 Nov. 1960, *Mooney 8611* (ETH, K); about 10 km SW of Jimma, 18 Dec. 1965, *W. J. de Wilde & de Wilde-Duyfjes 9270* (C, ETH, K, WAG). **Sidamo Region:** Zimbaba (5°50′N, 39°10′E), 14 Oct. 1962, *Mooney 9707* (ETH, WAG). **Bale Region:** Kumbi (6°25′N, 39°25′E), 29 Dec. 1959, *Mooney 8469* (ETH, K).

Acknowledgments. Material has been obtained on loan from ETH, K, and UPS, and WAG has provided xerox copies of their herbarium specimens. I thank the directors and curators of these herbaria and Alan Paton at K for critical comments on my manuscript.

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Jacquemontia revoluta (Convolvulaceae), a New Species from Minas Gerais, Brazil

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ABSTRACT. A new species of Convolvulaceae, *Jacquemontia revoluta* Simão-Bianchini, is described and illustrated. This species is known only from the rocky slopes of Serra do Cipó (Minas Gerais, Brazil), where it is associated with ant nests. The taxon is distinct in the genus by the linear leaves with revolute margins and 5-stellate (almost scale-like) trichomes. In addition to the description and illustration, comments on its probable relationships, habitat, and distribution are presented. *Jacquemontia revoluta* is probably related to *J. linoides* (Choisy) Meissner; both species are rare.

Jacquemontia Choisy is a fairly large genus with 174 taxa described and about 126 species accepted at present. The remaining 48 names have been placed in synonymy of other species of *Jacquemontia* or transferred to *Ipomoea*, *Iseia*, or *Odonellia*. The genus occurs primarily in the American tropics. The latest revisionary treatment of this genus is the one by Robertson (1971), which considers 54 names in 27 species; this study did not include the species from South America, only mentioning 40–50 species in the region. Meissner (1869) referred to 33 Brazilian species, and other treatments of the genus are related to local floras (O'Donell, 1960a, 1960b; Austin, 1975, 1982a, 1982b).

During floristic surveys of the Convolvulaceae of the Espinhaço range in the state of Minas Gerais, Brazil (Simão-Bianchini & Pirani, 1997), a new species of *Jacquemontia* was found. *Jacquemontia revoluta* Simão-Bianchini, here presented, is known only from the Serra do Cipó, a region rich in endemic taxa, many of them recently described.

Jacquemontia revoluta Simão-Bianchini, sp. nov. TYPE: Brazil. Minas Gerais: Santana do Riacho, Serra do Cipó, Rodovia Belo Horizonte–Conceição do Mato Dentro km 108, 7 May 1987 (fl, fr), *R. Simão & V. C. Souza CFSC 10090* (holotype, SPF; isotypes, K, SP). Figure 1.

Suffutex, ramis erectis vel adscendentibus, 20–40 cm longis, pubescentia adpresso-stellata, internodiis 0.5–1.5(–2.5) cm longis. Folia attenuata linearia, acuta, margine revoluta, pubescentia stellata, parca, 2–5 cm longa, 0.5–1 mm lata, brevissime petiolata. Cymae 1–3 flora, pedunculis axillaribus, 3–7 mm, bracteis exiguis, pedicellis (1–)3–5 mm; sepala ovata vel ovalia-oblonga acutiuscula, subaequalia, glabra, 2–4 mm longa, 1–3 mm lata; corolla campanulata pallide coerulea, 7–10 mm longa; stigmata 2, ovalia, divaricata. Capsula bilocularis, 4-valvis; semina glabra.

Perennial undershrubs, stems erect or ascending, 20–40 cm tall, glabrescent, trichomes appressed-stellate, short-stalked, scale-like, internodes 0.5–1.5(–2.5) cm long. Leaves simple, entire, attenuate-linear, base and apex acute, margins revolute, glabrescent, sparsely stellate trichomes with 5 appressed, equal branches or one bigger and patent, blade 2–5 cm long, 0.5–1 mm wide, petiole 0–2 mm long. Inflorescence cymose 1–3-flowered, axillary, peduncles 3–7 mm long, bracts linear, 1 mm long, pedicels (1–)3–5 mm long; 5 sepals subequal, ovate to ovate-oblong, acute, glabrous, 2–4 mm long, 1–3 mm wide; corolla campanulate, pale blue, 7–10 mm long, anthers ovate, with cordate bases and obtuse apices. Ovary glabrous, 2-locular, the locules 2-ovulate, stigmas 2, ellipsoid. Fruit capsular, 4-valvate, seeds 4, glabrous.

Superficially, *J. revoluta* resembles an *Evolvulus* because of the erect habit and small flowers, but its stigmas are characteristic of the genus *Jacquemontia*. This species is clearly distinct from the others in *Jacquemontia* by the linear leaves and the indument of appressed-stellate trichomes, somewhat hyaline, with 5 equal branches (scale-like), or 4 small and 1 long and patent (Fig. 1B).

Jacquemontia revoluta is similar to *J. linoides* (Choisy) Meissner, but this species is entirely glabrous, bearing leaves that are larger and without revolute margins, and the inflorescence has a long peduncle up to 7 cm, with 6 flowers. Both of them are rare: *Jacquemontia linoides* is known only from Bahia and Maranhão (the type was collected at Sertão, maybe from Bahia), while *J. revoluta* is restricted to stony slopes on the Serra do Cipó, where it has always been found associated with ant nests.

Paratypes. BRAZIL. **Minas Gerais:** Santana do Ria-

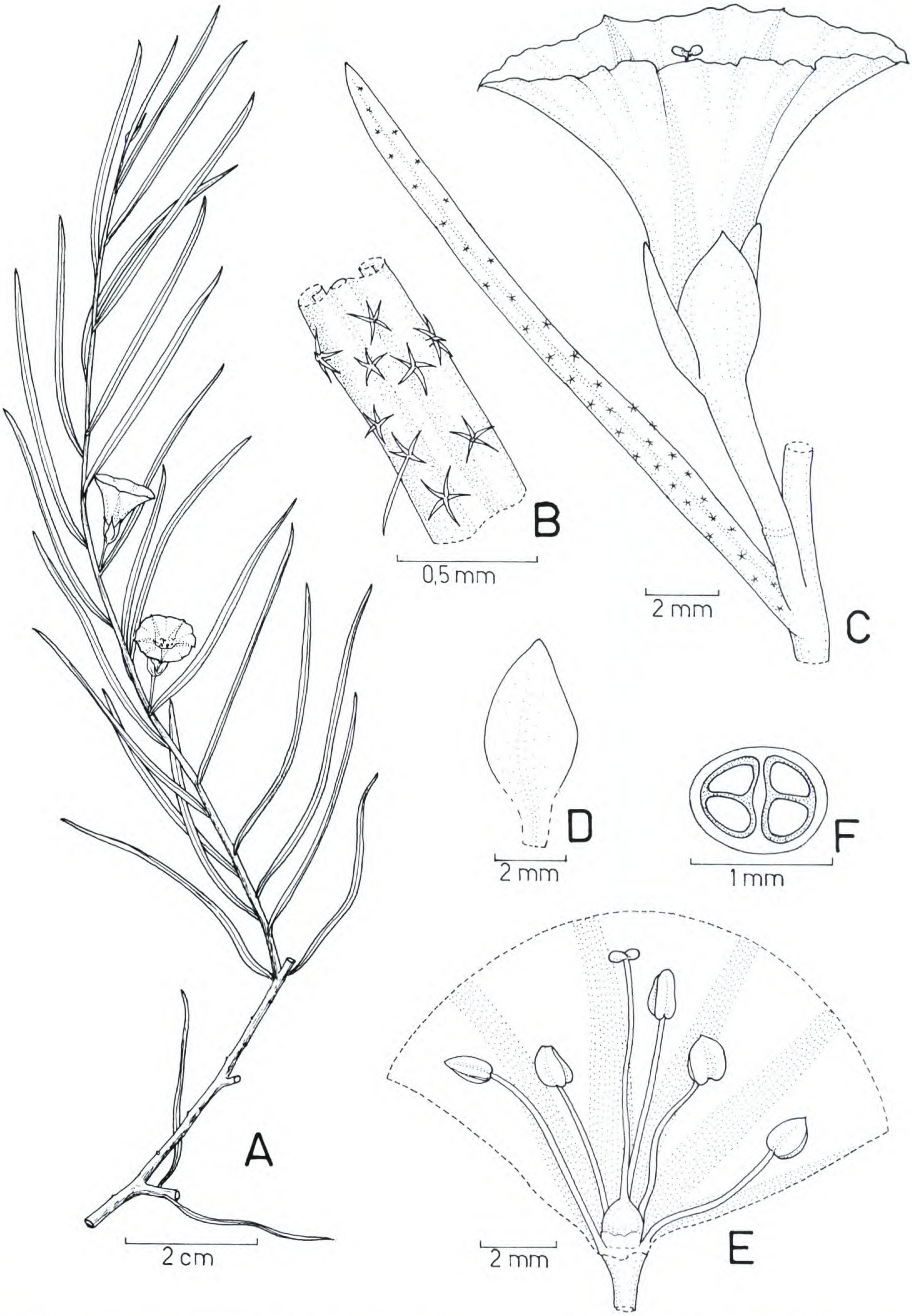

Figure 1. *Jacquemontia revoluta* Simão-Bianchini. —A. Flowering branch. —B. Part of the leaf blade showing the stellate trichomes and the revolute margins. —C. Detail of flower. —D. Sepal. —E. Corolla split longitudinally to show gynoecium and stamens, the calyx having been removed. —F. Ovary transversally sectioned showing 2 locules with 2 ovules in each one.

cho, Serra do Cipó, Rodovia Belo Horizonte–Conceição do Mato Dentro km 110, 24 Mar. 1986 (fl), *D. C. Zappi & C. Kameyama CFSC 9643* (SPF), 14 Apr. 1987 (fl, fr), *V. C. Souza CFSC 10075* (SP, SPF); Chapéu de Sol, Dec. 1958 (fl), *A. P. Duarte 4544* (B, HB, SI).

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A New Species, Notes on Subgeneric Taxa, and New Synonyms in *Hessea* (Amaryllidaceae: Amaryllideae) from South Africa

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ABSTRACT. *Hessea tenuipedicellata*, a new granite-loving species from Namaqualand, shares slender, pliant, upwardly curved pedicels, white flowers, and channeled, narrow, tepals with *H. stenosiphon* (Snijman) D. & U. Müller-Doblies. *Hessea* subg. *Hessea* is amplified to include *H. tenuipedicellata* and *H. stenosiphon*, and *H.* subg. *Kamiesbergia* (Snijman) Snijman is a new synonym of *H.* subg. *Hessea*. In *H.* subg. *Namaquanula* (D. & U. Müller-Doblies) Snijman, *Namaquanula etesionamibensis* D. & U. Müller-Doblies is a new synonym of *Hessea bruce-bayeri* (D. & U. Müller-Doblies) Snijman.

Hessea Herbert, a genus of small autumn-flowering plants, is endemic to the winter and autumn-rainfall regions of the Nama Karoo, Succulent Karoo, and Fynbos biomes in southern Africa. Cladistic analysis of tribe Amaryllideae using morphological data showed that *Hessea* resolves within subtribe Amaryllidinae in a terminal clade that includes its actinomorphic-flowered allies, *Strumaria* Jacquin and *Carpolyza* Salisbury. The subtribe is recognized by filaments that are connate at the base but are secondarily free in *Carpolyza* and some species of *Strumaria*; by seeds that have chlorophyll in the integument; and by stomata on the testa (Snijman & Linder, 1996). Other representatives of the subtribe that are basal to *Hessea*, *Strumaria*, and *Carpolyza* are *Amaryllis* L., which has unique pink to white seeds, *Nerine* Herbert, *Brunsvigia* Heister, and *Crossyne* Salisbury. *Hessea* sensu Snijman (1994) is divided into three subgenera that share derived floral characters. The perigone in *Hessea* is actinomorphic, and this ultimately turns brown and remains open with age, unlike the perigone that becomes deeply pigmented and finally collapses in all other actinomorphic-flowered Amaryllidinae.

NEW SPECIES

Hessea tenuipedicellata was first collected in leaf on the southernmost boundary of the Namaqualand rocky hills in 1992. The hysteranthous-leaved bulbs flowered in cultivation one year later and produced distinctive, delicate, white flowers, which confirmed that the plant was undescribed. Like all representatives of subgenus *Hessea* sensu Snijman (1994), the species has distinctly centrifixed anthers, a condition that results from the sheath in the anther connective having equally long dorsal and ventral walls (Müller-Doblies & Müller-Doblies, 1985). In addition, the plant has basally fused stamens and two foliage leaves surrounded by a sheathing cataphyll: characters that conform with the narrowly defined *Hessea* sensu Müller-Doblies and Müller-Doblies (1985, 1992).

Hessea tenuipedicellata Snijman, sp. nov. TYPE: South Africa. Northern Cape Province: 3018 (Kamiesberg) farm Uilklip, N boundary of Knersvlakte, in pockets of loamy soil on granite domes (DC), 19 Apr. 1994, *Snijman 1437* (holotype, NBG; isotypes, MO, PRE). Figure 1.

Species nova *Hesseae stenosiphoni* affinis, cujus pedicellos tenues flexibiles sursum curvos, flores albos et tepala angusta canaliculata habet. Differt perigonii tubo brevissimo et filamentis haud bis articulatis.

Delicate, deciduous bulbous herb. *Bulb* solitary, deep seated, subglobose, ca. 15 mm across, covered with brown, cobwebby tunics; producing annually a non-sheathing prophyll, a sheathing cataphyll, a sheathing foliage leaf, and a non-sheathing foliage leaf; neck slender, up to 8 cm long. *Foliage leaves* 2, absent at anthesis, linear, opposite, spreading slightly, up to 16 cm long, ca. 1 mm wide, glabrous. *Inflorescence* umbel-like, lax, 13 cm across; scape slightly curved, rigid, dry, slender, 7.5–13.0 cm long, 1 mm thick, putty-colored, reddened basally; spathe valves 2, linear-lanceolate, 1.5–2.1 cm long, 1.5 mm across proximally, transparent with pinkish veins; bracteoles not visible; pedicels pliant, slender, upwardly curved, 5–10 cm long, ca. 1 mm across, green. *Flowers* 5–12, opening sequentially at 1- to 4-day intervals, suberect to spreading, substellate, up to 15 mm across, glistening white, often with a lemon-green center, sometimes with pale green toward the base of the outer surface, cream

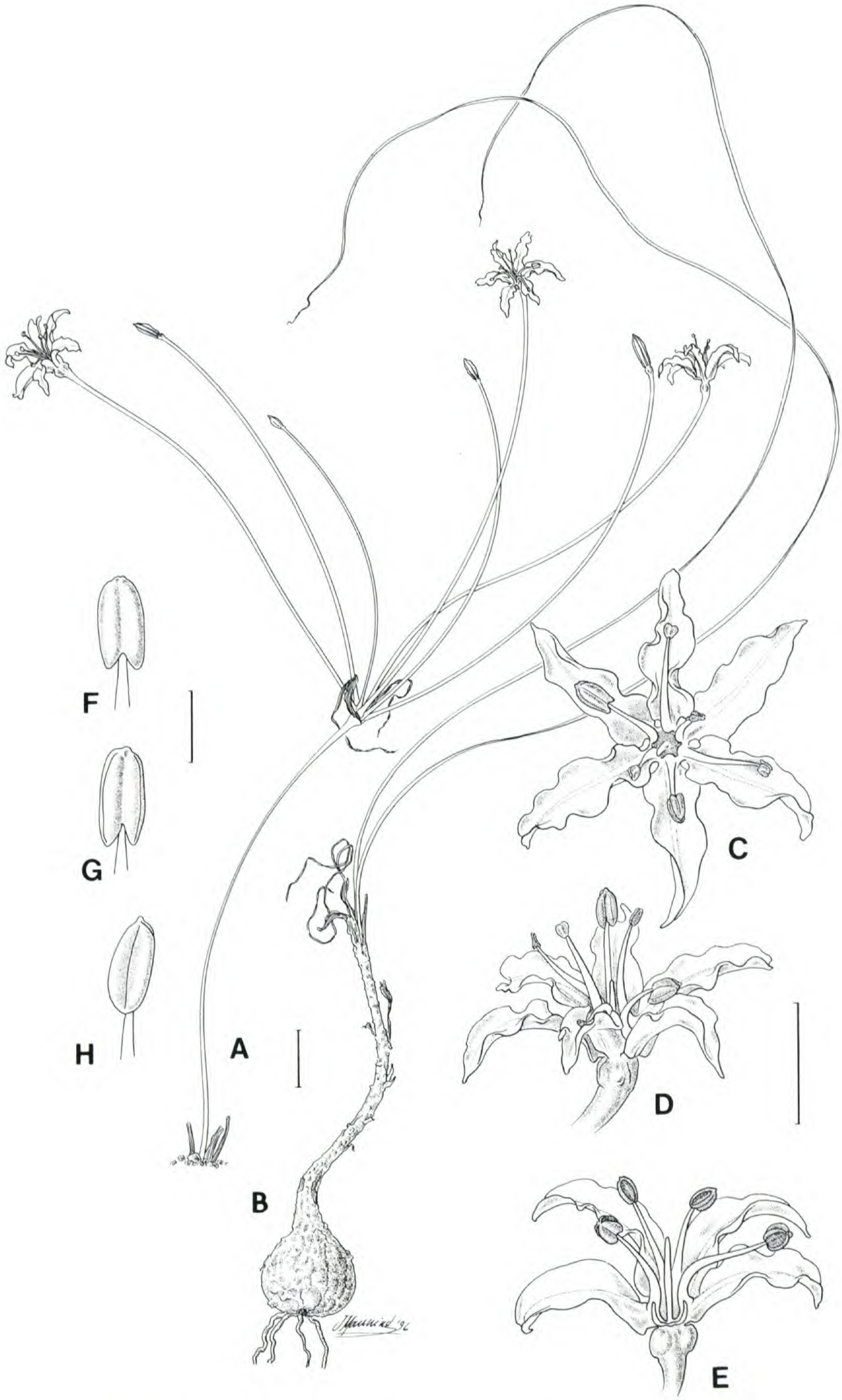

Figure 1. *Hessea tenuipedicellata* Snijman. —A. Inflorescence. —B. Mature leaves and bulb. —C. Flower from above. —D. Flower, lateral view. —E. Flower with two tepals and stamens removed. —F. Anther, dorsal view. —G. Anther, ventral view. —H. Anther, lateral view. Scale bars: A, B = 10 mm; C–E = 5 mm; F–H = 1 mm. Drawn by John C. Manning. Based on *Snijman 1437*.

to pale lemon in bud, ± scented, remaining open and turning light brown with age. *Tepals* 6, scarcely connate but adnate to filament tube for ca. 1 mm, recurved in the distal half, 5–9 mm long, 2.5 mm wide, with a thickened midrib in the proximal quarter, channeled, sometimes with strongly undulate edges. *Stamens* 6, 5–6 mm long, slightly shorter than the tepals; filaments connate into a tube 1.5 mm long; anthers centrifixed, 1.5 mm long before dehiscence, wine-red; pollen cream-colored. *Ovary* with 3 ovules per locule. *Style* slender, up to 5 mm long; stigma trifid; nectar centrally pooled around style base. *Fruit* not seen.

Phenology. The main flowering period in the wild is confined to a few weeks between mid-April and early May. The leaves appear shortly after flowering and die back with the onset of the summer drought, usually in September.

Distribution, habitat, and ecology. *Hessea tenuipedicellata* is known from only one locality on the eastern slopes of the Uilklipberg, an isolated granite mountain surrounded by the flat, sandy plains of the northern Knersvlakte in Namaqualand, South Africa. The population of a few hundred plants is confined to pockets of soil on large granite domes. Several patches showed disturbance by porcupines, but the effect on the bulbs could not be gauged. The permanent vegetation cover consists of sparse, succulent perennials, of which the asteraceous stem succulent, *Senecio junceus* Harvey, is most abundant. The closely related *H. stenosiphon* (Snijman) D. & U. Müller-Doblies occurs in similar edaphic sites approximately 65 km to the northwest, on exposed granite rocks of the Kamiesberg and its high-lying foothills (Fig. 2). In addition to the geographic distance that separates the species, several important differences in floral structure probably effect ecological isolation. The flowers in *H. tenuipedicellata* are substellate and short-tubed (1 mm long), with widely spreading filaments and a well-exserted style. In contrast, the hypocrateriform flowers of *H. stenosiphon* have a style hidden within a narrow, 8–12-mm-long perigone tube, and outer anthers that occlude the perigone throat. Even if these species attract the same insect visitors, it is nevertheless likely that their flowers deposit pollen in places where the stigma of the other species in the pair is unable to contact it.

Most species of *Hessea* have straight, rigid pedicels at anthesis, and flowers that vary from pink to white with dark pink to red markings. In contrast, *H. tenuipedicellata* is easily recognized by its long, slender, pliant, upwardly curved pedicels, and glistening white flowers that lack pink markings.

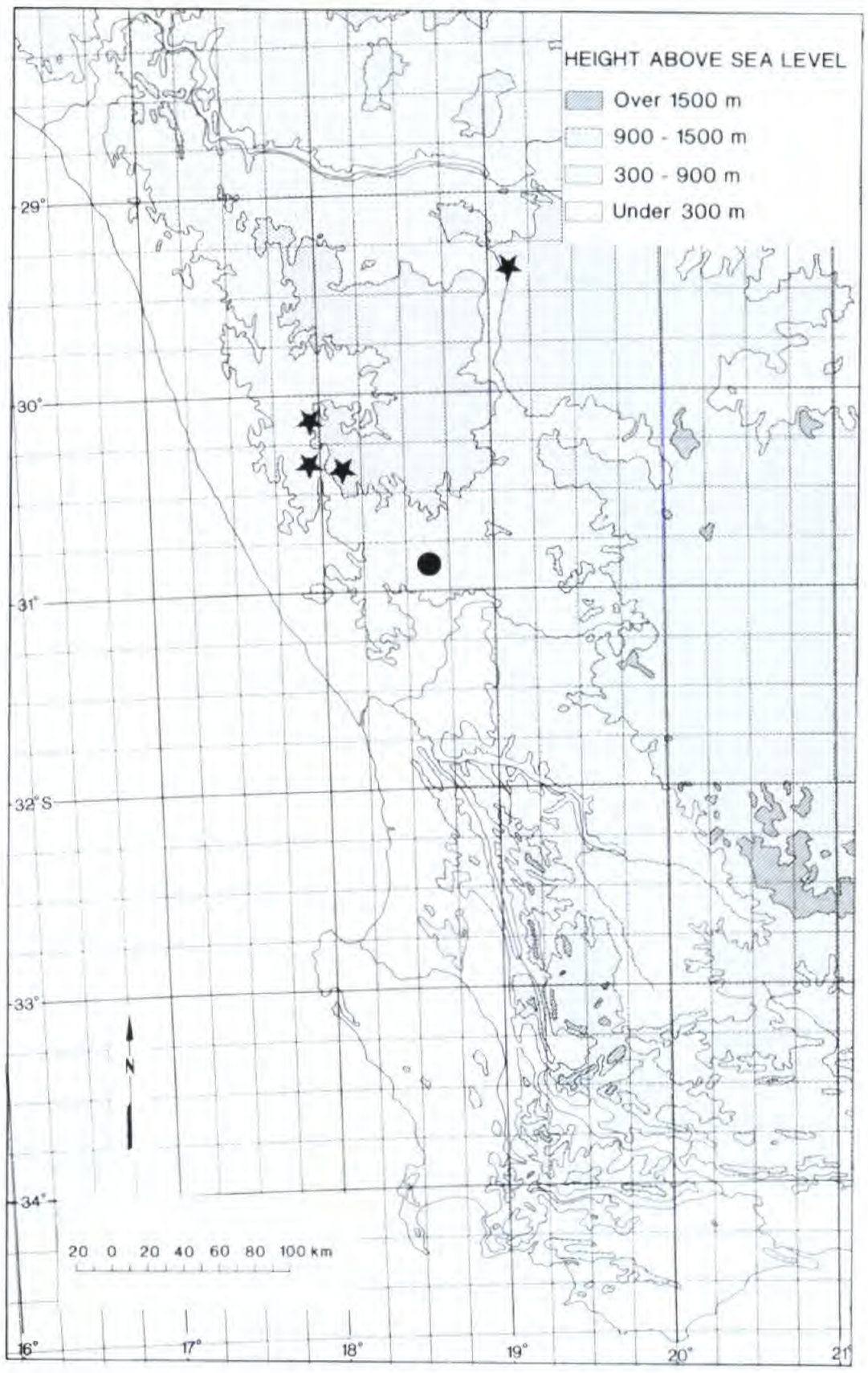

Figure 2. Known distribution of *Hessea tenuipedicellata* (dot) and *H. stenosiphon* (star).

Furthermore, the substellate flowers have channeled, narrow tepals, and each flower opens at one- to four-day intervals so that few reach anthesis simultaneously (Fig. 1). The only other known *Hessea* species with similar slender green pedicels, a sequential flowering pattern, and channeled, narrow, whitish tepals is *H. stenosiphon.* According to Snijman (1994), this species belongs to the monotypic subgenus *Kamiesbergia* (Snijman) Snijman, which was defined by several unique characters: hypocrateriform flowers; dimorphic stamens; and anthers in which the pocket that encloses the filament tip is extremely short and is located near the base of the connective.

Paratypes. SOUTH AFRICA. **Northern Cape Province:** 3018 (Kamiesberg) farm Uilklip, SW of Kliprand (DC), 16 Aug. 1992, *Bruyns 5312* (K, NBG, PRE), 6 Apr. 1994, *Snijman 1422* (NBG).

NEW SYNONYMS

Hessea subg. **Hessea.** TYPE: *Hessea stellaris* (Jacquin) Herbert, typ. cons.

Kamiesbergia Snijman, Bothalia 21: 125. 1991. *Hessea*

subg. *Kamiesbergia* (Snijman) Snijman, Contr. Bolus Herb. 16: 71. 1994. Syn. nov. TYPE: *Kamiesbergia stenosiphon* Snijman (= *Hessea stenosiphon* (Snijman) D. & U. Müller-Doblies).

The morphology of *Hessea tenuipedicellata*, which is intermediate between subgenus *Hessea* and subgenus *Kamiesbergia*, presents evidence additional to that of Müller-Doblies and Müller-Doblies (1992) that two of the three subgenera recognized by Snijman (1994) should be combined. *Hessea* subg. *Hessea* is amplified to include *H. tenuipedicellata* and *H. stenosiphon*, and *H.* subg. *Kamiesbergia* is placed into synonymy under subgenus *Hessea*. With this new delimitation, subgenus *Hessea* matches genus *Hessea* sensu Müller-Doblies and Müller-Doblies (1992), except in rank and the number of species recognized in each. The taxon is characterized by derived centrifixed anthers of which the more or less basifixed state in *H. stenosiphon* (Snijman, 1994) is inferred to result from a reduction in the length of the sheath in the anther connective (Müller-Doblies & Müller-Doblies, 1992).

Hessea bruce-bayeri (D. & U. Müller-Doblies) Snijman, Contr. Bolus Herb. 16: 75. 1994. *Namaquanula bruce-bayeri* D. & U. Müller-Doblies, Bot. Jahrb. Syst. 107: 20. 1985. TYPE: South Africa. Northern Cape Province: 2816 (Oranjemund) Perdemonde, 1.5 km N of Kuboos/Oranjemund road on road to Koeskop (BC), 10 Mar. 1979, *U. & D. Müller-Doblies 79112a* (holotype, PRE).

Namaquanula etesionamibensis D. & U. Müller-Doblies, Feddes Repert. 105: 333. 1994. Syn. nov. TYPE: Namibia. 2817 (Vioolsdrif) Dabimub River, 27 km E of Rosh Pinah waterworks, gravel terraces along Orange River (AA), 8 Aug. 1988, *U. & D. Müller-Doblies 88070c* (holotype, WIND; putative isotypes, BOL, PRE, STE, not yet deposited, not seen).

With the discovery of *H. tenuipedicellata*, the genus *Hessea* sensu Snijman (1994) is considered to have 14 species. Described from a few collections that flowered poorly in cultivation, *Namaquanula etesionamibensis* D. & U. Müller-Doblies was delimited from *Namaquanula bruce-bayeri* D. & U. Müller-Doblies (= *Hessea bruce-bayeri* (D. & U. Müller-Doblies) Snijman) by small quantitative characters, primarily of the flower: the perigone is 10–12 mm, not 5–8 mm long; the tepals are widely as opposed to slightly spreading; and trichomes are absent above the hook borne near the base of each filament (Müller-Doblies & Müller-Doblies, 1994). Additional specimens from the alluvial gravel plains along the Orange River, which D. and U. Müller-Doblies did not examine, are florally intermediate between *N. etesionamibensis* and *N. bruce-bayeri*. *Williamson 3405* (Snijman, 1994: fig. 34) in particular has a perigone 5–6 mm long, spreading tepals, and trichomes on and below the filament hooks. To encompass the continuous, clinal variation now evident in the populations located north and south of the Orange River, *Namaquanula etesionamibensis* is placed into synonymy under *H. bruce-bayeri* in *H.* subg. *Namaquanula* sensu Snijman (1994). Thus the perigone of *H. bruce-bayeri* varies from approximately as long as the filaments in specimens from the Aus district, southern Namibia, to half as long as the filaments in those from the Richtersveld, South Africa.

Additional specimens examined. NAMIBIA. 2716 (Witputz), 27°50′S, 16°36′W (DC), 30 Mar. 1986, *Van Berkel 549* (NBG, PRE); 2816 (Oranjemund), 1 mi. N of Orange River at Sendlings Drift (BB), Mar. 1960, *Hall 1901* (NBG). SOUTH AFRICA. **Northern Cape Province:** 2816 (Oranjemund) Perdemonde, E of Arrisdrif (BC), 10 Mar. 1977, *Bayer 350* (NBG); 4 km NE of Beesbank (BC), 10 Mar. 1985, *Williamson 3405* (K, NBG, PRE).

Acknowledgments. I thank Danny Geldenhuys for bringing this new species to my attention; Peter Bruyns, Jasper and Bertha Coetzee, Callie and Alta Meyer, and Colin Paterson-Jones for assistance during field studies; Peter Goldblatt for advice on the manuscript; and John Manning for the illustration.

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A New *Rhadamanthus* Species (Hyacinthaceae) from the Northwestern Cape, South Africa

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ABSTRACT. *Rhadamanthus involutus* is a rare, hysteranthous-leaved species from the Bokkeveld Escarpment, west of Nieuwoudtville, Northern Cape Province, South Africa. Most closely related to *R. albiflorus* B. Nordenstam, *R. involutus* is distinguished by apically recurved outer tepals that are conspicuously spotted with green at the base, and suberect inner tepals that have involute margins which overlap to form a tube. The bulbs grow on exposed sandstone sheets between patches of dry fynbos and flower in midsummer.

Rhadamanthus Salisbury is a small, poorly understood genus of Hyacinthaceae that is endemic to southern Africa. Nordenstam (1970) and Obermeyer (1980) recognized 11 species, mostly from semi-arid habitats in the Nama Karoo, Succulent Karoo, and Fynbos biomes (see Rutherford, 1997). The genus is distinguished from its close ally, *Urginea* Steinheil, solely by its derived anther dehiscence. Unlike the unspecialized, longitudinally dehiscent anthers of *Urginea*, the anthers in *Rhadamanthus* dehisce either apically, or if by longitudinal slits then these are initiated from the apex and extend below the midline but never reach the base of the thecae. Despite this variation, dehiscence in *Rhadamanthus* is never complete and the anther opening always remains somewhat pore-like, having its greatest width near the top of the anther (Nordenstam, 1970). Although subtle, Nordenstam (1970) chose to maintain this distinction, awaiting the resolution of the difficult and complex relationships between the remaining genera in tribe Scilleae (sensu Hutchinson, 1959). Jessop (1977) supported this view in his re-evaluation of *Drimia* Jacquin ex Willdenow, *Urginea*, and related genera.

Plants of *Rhadamanthus* are easily overlooked in the field. The leaves are consistently hysteranthous, the flowers are inconspicuous, and the bulbs flower during the unfavorable summer drought. Thus the geographic records of many *Rhadamanthus* species in Nordenstam's (1970) treatment of the genus are regarded as incomplete, and the fruit and seeds of several species still remain unknown.

Rhadamanthus involutus was first discovered in 1993 in flower in sparse, dry fynbos on the Bokkeveld Escarpment west of Nieuwoudtville, northwestern Cape. The flowers differ uniquely in the form, disposition, and markings of the outer and inner tepals. The tepals are unequal and biseriate, with the outer whorl distinctly overlapping the inner whorl at the base. The outer tepals recurve apically at anthesis and each bears a distinctive, basal, olive green spot. In contrast the inner tepals are unmarked, suberect, and involute so that each has a tapering tubular form. The non-nodding flowers are also unusual in the genus. Anther dehiscence in *R. involutus* is tardy and incomplete, and the longitudinal slits which proceed from the apex of the thecae do not extend to the base. Obermeyer (1980) recognized four other species of *Rhadamanthus* (*R. fasciatus* B. Nordenstam, *R. albiflorus* B. Nordenstam, *R. namibensis* Obermeyer, and *R. karooicus* Obermeyer) with this type of anther dehiscence and described subgenus *Rhadamanthopsis* Obermeyer to accommodate them. *Rhadamanthus involutus* is the fifth known species of this subgenus. Although its affinities in the genus are not well understood, *R. involutus* has white flowers and extremely short filaments relative to the anthers. These characters also occur in *R. albiflorus* and suggest an alliance with this southwestern Cape species.

Field observations on the bees (family Anthophoridae) that visit the flowers of *R. involutus* indicate that the anther dehiscence in *Rhadamanthus* is associated with pollination by bee vibration. Additional characters that *Rhadamanthus* species share with other known buzz-pollinated taxa (Er-

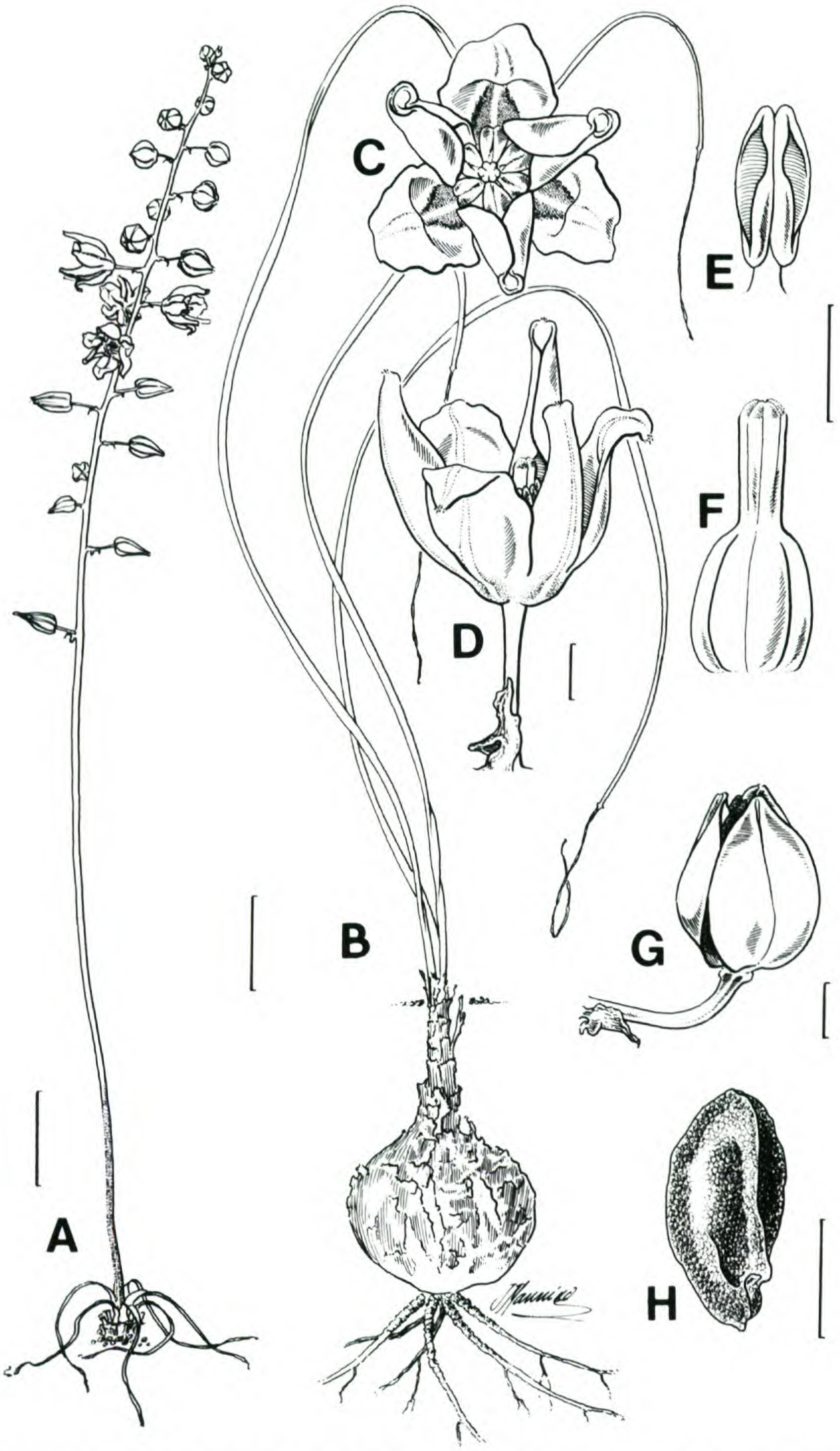

Figure 1. *Rhadamanthus involutus* J. C. Manning & Snijman. —A. Inflorescence. —B. Bulb and mature leaves. —C. Flower, view from above. —D. Flower, lateral view. —E. Anther after dehiscence. —F. Gynoecium. —G. Mature capsule. —H. Seed. Scale bars: A, B = 1 cm: C–H = 1 mm. Drawn by John C. Manning. Based on *Snijman & Manning 1525.*

ickson & Buchmann, 1983) are the stigma, which is inconspicuous and dry, and the stamens, which converge around the pistil. Whether the pollen morphology of *Rhadamanthus* is consistent with that of other buzz-pollinated taxa (see Erickson & Buchmann, 1983) still requires confirmation, but it is certainly dry.

Rhadamanthus involutus J. C. Manning & Snijman, sp. nov. TYPE: South Africa. Northern Cape Province: 3119 (Calvinia) Bokkeveld Escarpment, farm Arendskraal, W of Nieuwoudtville, in humus-rich soil amongst exposed sandstone sheets (AC), 20 Dec. 1995, *Snijman & Manning 1525* (holotype, NBG; isotypes, K, MO, PRE). Figure 1.

Bulbus ovoideus. Folia 3–6 filiformia suberecta glabra. Scapus erectus minute puberulus prope basin. Bracteae inferiores breviter calcaratae. Perigonium campanulatum, tepalis biseriatis albidis basi connatis. Tepala exteriora recurvata versus apicalia, conspicue maculata basi. Tepala interiora marginibus involutis et imbricatis. Filamenta brevissima. Antherae connivenes, thecis desuper tandem supra basin dehiscentibus.

Deciduous bulbous herb. *Bulb* solitary or rarely clumped, ovoid, 2–3 cm wide, extended into a neck up to 1.5 cm long; outer coat brown, papery; inner scales tightly overlapping, white, fleshy. *Leaves* hysteranthous, up to 6, suberect; base non-amplexicaul; blade filiform, up to 20 cm long, hemiterete, glabrous, dark green with a pale apricot-colored base, dying back from the tip. *Inflorescences* 2 per shoot, usually maturing one at a time within the same season; scape erect, straight, up to 16 cm long, ca. 1 mm diam. at the middle, with minute papillae arranged in vertical lines toward the base; raceme ca. 3–7 cm long, straight, with 16–20 flowers arranged in a loose spiral; bracts 1.5–2.0 mm long, oblong to square, apiculate, the lower spurred; spur 0.5–1.0 mm long; pedicels patent, 3–4 mm long, glabrous. *Flowers* spreading, campanulate, 2–5 open at a time. *Tepals* biseriate, with the outer whorl overlapping the inner whorl at the base, ca. 4.0 × 2.5 mm, glistening white with a greenish brown midrib, basally fused for ca. 1 mm; outer tepals ovate, shallowly cup-shaped in the proximal half, bearing a conspicuous olive green eye outlined with reddish brown at the base, recurved distally, with a minutely penicillate apex; inner tepals shortly clawed and closely adpressed to the stamens basally, with involute margins in the upper two-thirds forming a distally tapering tube, glabrous at the apex. *Stamens* adnate to the perigone base for ca. 0.5 mm; filaments smooth, flat, 0.5 mm long; anthers basifixed, introrse, 1.5 mm long, brownish orange, arching inward and covering the ovary, dehiscing tardily by longitudinal slits from the apex to just short of the base, with slits remaining widest in the upper half; thecae rounded and glabrous basally; pollen yellow. *Ovary* ovoid, 1.5 mm long, brownish orange; style columnar, 1.5 mm long, white, apically truncate with a shallowly three-sulcate stigma. *Capsule* ca. 3 × 3 mm, ovoid, erect on curved erecto-patent pedicels, glossy, golden green. *Seeds* compressed, elliptic-oblong to reniform, ca. 2 mm long, shiny black, irregularly folded and wrinkled, finely reticulate.

Phenology. Peak flowering is limited to a few weeks in late November and early December. The leaves appear in autumn and die back with the advent of the summer drought.

Distribution and habitat. Rhadamanthus involutus is known from two populations on the Bokkeveld Escarpment, west of Nieuwoudtville in the Northern Cape Province. The populations, comprising a few hundred plants, are found in seasonally moist, open patches of humus-rich soil between exposed sandstone sheets. The surrounding vegetation is sparse, dry fynbos.

Paratype. SOUTH AFRICA. **Northern Cape Province:** 3119(Calvinia) Nieuwoudtville, top of Vanrhynspas (AC), 30 Nov. 1993, *Manning 2098* (NBG).

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Valeriana tajuvensis (Valerianaceae), a New Species from Southern Brazil

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ABSTRACT. *Valeriana tajuvensis*, a species from the Serra Geral massif in Rio Grande do Sul and Santa Catarina, Brazil, is described and compared with related Brazilian species of the genus.

RESUMEN. *Valeriana tajuvensis*, especie de las montañas de Serra Geral en Rio Grande do Sul y Santa Catarina, Brasil, es descrita y comparada con las especies brasileñas afines del género.

The last specific study of the genus *Valeriana* in Brazil (Borsini, 1962) listed 15 species, all of them consisting of herbs restricted to the southern and southeastern states of the country and generally collected in montane or submontane habitats.

During recent fieldwork on a montane massif in the southernmost Brazilian state of Rio Grande do Sul, a strikingly distinct, arborescent, and somewhat uncommon species of *Valeriana* was collected; it is described here.

Valeriana tajuvensis Sobral, sp. nov. TYPE: Brazil. Rio Grande do Sul: Tajuva, mun. Morrinhos do Sul (29°21′S, 49°58′W), 19 Aug. 1995 (hermaphrodite fl), *J. A. Jarenkow 2708 & M. Sobral* (holotype, ICN; isotypes, MBM, PEL, SP). Figures 1, 2.

Species haec *V. polystachyae* et *V. kurtzianae* proxima, a quarum habitus arborescenti, ramificatione sympodialis foliisque apici ramorum aggregatis distincta est.

Gynodioecious shrub 1–3 m high, profusely sympodially ramified, the branches bearing conspicuous leaf scars; canopy 2.5–3 m diam. Leaves opposite, somewhat tufted at the apex of the branches; blades pinnatisect with elliptic-obovate profile, 8.5–18 cm long, 4–7 cm wide, 15–24-lobed (discounting 4–5 strongly reduced proximal lobes at the base of pseudopetioles), the abaxial face very sparsely glandular-punctate, the glands less than 0.1 mm diam., lobes with the margin slightly revolute, unequal in size, the 4–5 proximal pairs at the base of the pseudopetioles (1–)3–10 mm long, (0.3)1–1.5 mm wide, the others 30–45 mm long and 4–5 mm wide, markedly asymmetrical, the terminal 30–40 mm long and 3–3.5 mm wide, symmetrical; pseudopetioles 4–15 mm long, each pair of leaves connected at base forming a continuous nodal sheath. Inflorescences paniculiform with the final units dichasial, in hermaphrodite plants 20–30 cm long and 10–15 cm wide, in pistillate ones 15–20 cm long and 5–8 cm wide, due to the reduction of secondary ramifications (paracladia sensu Larsen, 1989); proximal bracts similar to leaves, about 6 cm long and 3 cm wide; distal bracts simple and lanceolate, 8–10 mm long and 1–1.5 mm wide; bracteoles lanceolate, 1.5–1.8 mm long and 0.5 mm wide, sometimes with sparse tufts of hairs 0.1 mm long in the base. Flowers sessile, pentamerous, the calyx with 4–5 loosely distinct to completely fused segments, forming a hyaline ring 0.2–0.4 mm high; corolla white, campanulate, with straight tube. Hermaphrodite flowers with corolla about 2 mm long and 2 mm wide, lobes 0.8 mm long and 0.6–0.7 mm wide; stamens attached at about the middle of the corolla, 2–4, generally 3, exserted, filaments about 2 mm long, anthers 2-lobed, globose, the locules in a same anther slightly unequal, about 0.3 mm long; style included, about 1 mm long, stigmas 3, 0.2–0.3 mm; ovary inferior, triquetrous in shape, filled with parenchymatous tissue, unilocular, uniovulate; ovule pendulous. Pistillate flowers with corolla 0.5–0.8 mm long and 0.5 mm wide, the lobes about 0.3 mm long and wide; stamens 3, included, 0.2–0.3 mm long, anthers globose with somewhat unequal locules, about 0.2 mm long, not producing pollen in the flowers examined; style 1.3–1.5 mm long, stigmas 3, exserted, 0.1–0.2 mm long; ovary the same as in hermaphrodite flowers. Fruits triquetrous, asymmetrical in transversal view, 2–2.3 mm long and 1.1–1.3 mm wide, uniseminate, sparsely pilose, eventually somewhat more densely so at the edges. Seeds examined immature.

Arborescent species of *Valeriana* are quite common in the Andean highlands of Colombia, Peru, and Venezuela (Killip, 1925, 1928; Cuatrecasas, 1941; Xena, 1992), the region where *Valeriana* at-

Figure 1. *Valeriana tajuvensis*. Branch of hermaphrodite plant, drawn from holotype (*Jarenkow 2708*).

tains its highest diversity in the Neotropics (Meyer, 1951). Nevertheless, woodiness was not known in eastern South American species (Müller, 1885; Borsini, 1962, 1963).

The leaves of *V. tajuvensis* resemble those of southern Brazilian and Argentine *V. polystachya* and *V. kurtziana*, but it may be distinguished from these two species by the following characters:

Habit herbaceous, sometimes rhizomatous, never

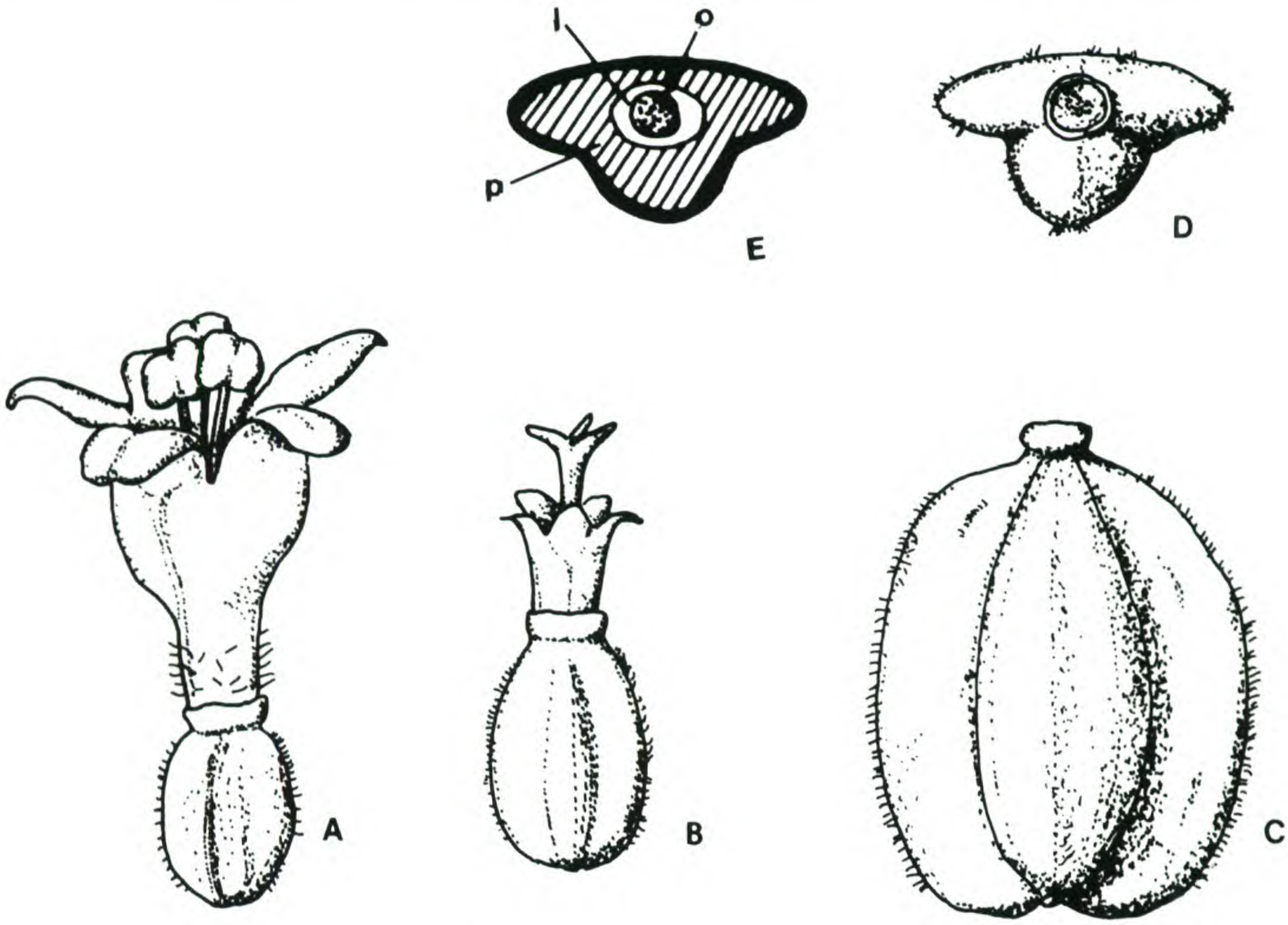

Figure 2. Flowers and fruits from *Valeriana tajuvensis*. —A. Hermaphrodite flower (*Jarenkow 2708*). —B. Feminine flower (*Jarenkow 2706*). —C. Fruit in frontal view. —D. Fruit in apical view. —E. Immature fruit, transversal section, schematic: l = locule, o = ovule, p = parenchymatous tissue (C–E, *Sobral 7945b*).

woody; ramification monopodial; leaves equally distributed along the entire plant . . . . . *Valeriana kurtziana* and *V. polystachya*

Habit arborescent, woody, never rhizomatous; ramification sympodial; leaves concentrated at the apex of the branches . . . . . *Valeriana tajuvensis*

Phenology. Flowering and simultaneously fruiting specimens were collected in July, August, and December.

Distribution. The species has been collected in Serra da Tajuva, in the state of Rio Grande do Sul, and Serra do Faxinal, state of Santa Catarina.

Ecology. Heliophilous and subxerophilous shrub growing on the eastern slopes of the southern Brazilian massif named Serra Geral, at altitudes between 500 and 700 m above sea level; at the collection site in Tajuva, it occurs either sporadically at the edge of submontane forests or in great densities of hundreds of individuals in more openly insolated and well-drained rocky fields; at Serra do Faxinal only two individuals were observed on a rocky roadside (Falkenberg, pers. comm.).

Paratypes. BRAZIL. **Rio Grande do Sul:** Serra da Tajuva, municipality of Morrinhos do Sul (29°21′S, 49°58′W), July 1995 (pistillate), *Sobral 7934a* (ICN), July 1995 (hermaphrodite), *Sobral 7934b* (ICN), Aug. 1995 (pist.), *Sobral 7945a & Miró* (ICN, RB), Aug. 1995 (herm.), *Sobral 7945b & Miró* (ICN), Aug. 1995 (pist.), *Jarenkow 2702 & Sobral* (ICN, MBM, PEL), Aug. 1995 (pist.) *Jarenkow 2706 & Sobral* (FLOR, ICN, MBM, PEL, RB, SP), Dec. 1995 (pist.), *Sobral 8010 & Jarenkow* (FLOR, MBM, MO). **Santa Catarina:** Serra do Faxinal, municipality of Praia Grande, Mar. 1997 (herm.), *Falkenberg 9797* (FLOR).

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A New Species of *Psychotria* Subg. *Heteropsychotria* (Rubiaceae) from the Adolpho Ducke Forest Reserve, Brazil

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ABSTRACT. The new species *Psychotria rhombibractea* C. M. Taylor & M. T. Campos, from wet forest in the Adolpho Ducke Forest Reserve, Manaus, Amazonas, Brazil, is here described and illustrated.

RESUMO. A nova especie *Psychotria rhombibractea* C. M. Taylor & M. T. Campos, com ocorrência na florestal tropical úmida, na Reserva Florestal Adolpho Ducke, Manaus, Brazil, é descrita e ilustrada.

During review of the Rubiaceae collected from the Adolpho Ducke Forest Reserve, in Manaus, Brazil, the following undescribed species was encountered.

Psychotria rhombibractea C. M. Taylor & M. T. Campos, sp. nov. TYPE: Brazil. Amazonas: Reserva Florestal Ducke, Manaus–Itacoatiara road, Km 26, 02°53′S, 59°58′W, Floresta de Platô, 28 setembro 1994 (fl), *M. J. G. Hopkins, E. da C. Pereira & C. F. da Silva 1483* (holotype, INPA; isotype, MO-5056257). Figure 1.

Haec species a *Psychotria officinali* (Aublet) Sandwith inflorescentiae bracteis ellipticis oblanceolatis vel plerumque rhombicis, corolla ex tubo 9–10 mm longo et lobis 5–8 mm longis constante atque fructus 4–6 × 6–8 mm pyrenis rugosis distinguitur.

Shrubs or small trees to 5 m tall; vegetative organs glabrous. *Leaves* opposite; *blades* elliptic to elliptic-oblong, 7–18 × 2–7 cm, at apex acuminate to rather long-acuminate, at base acute to cuneate, drying papyraceous; secondary veins 6–10 pairs, often uniting into a looping submarginal vein at least in distal part of blade, on both surfaces plane or sometimes prominulous; *petioles* 5–15 cm long; *stipules* persistent, united around the stem into a truncate or concave sheath 0.5–1 mm long, with lobes 2 on each side, deltoid, 0.5–1 mm long, ciliate at least when young. *Inflorescences* terminal, glabrous to minutely puberulous, with peduncle 8–20 mm long, flowering portion cymose, in outline rounded-corymbiform, 1–1.5 × 2–4 cm (excluding corollas), with secondary axes 1–3 pairs, paired but often appearing subverticillate, generally dichasial, with cymules subtended by bracts, these elliptic, oblanceolate, or usually rhombic, 3–10 mm long, obtuse to acute, white; *flowers* apparently distylous (this state not confirmed with field breeding study), sessile in cymules of 5–7, not individually bracteate; hypanthium (ovary portion) cylindrical to ellipsoid, 0.5–0.8 mm long, glabrous to minutely puberulous; *calyx* limb 0.2–0.5 mm long, minutely puberulous, shortly dentate, entire or ciliolate; *corolla* salverform to narrowly infundibuliform, white, externally and internally glabrous, tube 9–10 mm long, ca. 1 mm diam. near middle, lobes narrowly triangular to narrowly lanceolate, 5–8 mm long, 1–1.5 mm wide, at apex shortly rounded and a little thickened; *stamens* inserted above middle of corolla tube, in short-styled form with anthers ca. 2 mm long exserted on filaments ca. 4 mm long, in long-styled form with anthers ca. 2 mm long, subsessile, these anthers positioned near middle of corolla tube; *stigmas* linear, in short-styled form ca. 2 mm long and positioned near middle of tube, in long-styled form ca. 1 mm long and shortly exserted; disc annular, smooth, slightly exceeding calyx limb. *Infructescences* with bracts becoming purple to wine-red, magenta, red, or orange; *fruits* subglobose, somewhat didymous, 4–6 × 6–8 mm, red or purple-red; pyrenes 2, hemispheric to subglobose, on abaxial (dorsal) surface faintly longitudinally ridged and somewhat rugose throughout, on adaxial (ventral) face planar with a slight central ridge.

This species is known only from the Manaus area, where it has been collected primarily in the Adolpho Ducke Forest Reserve. Here it has been collected with flowers September–November, with

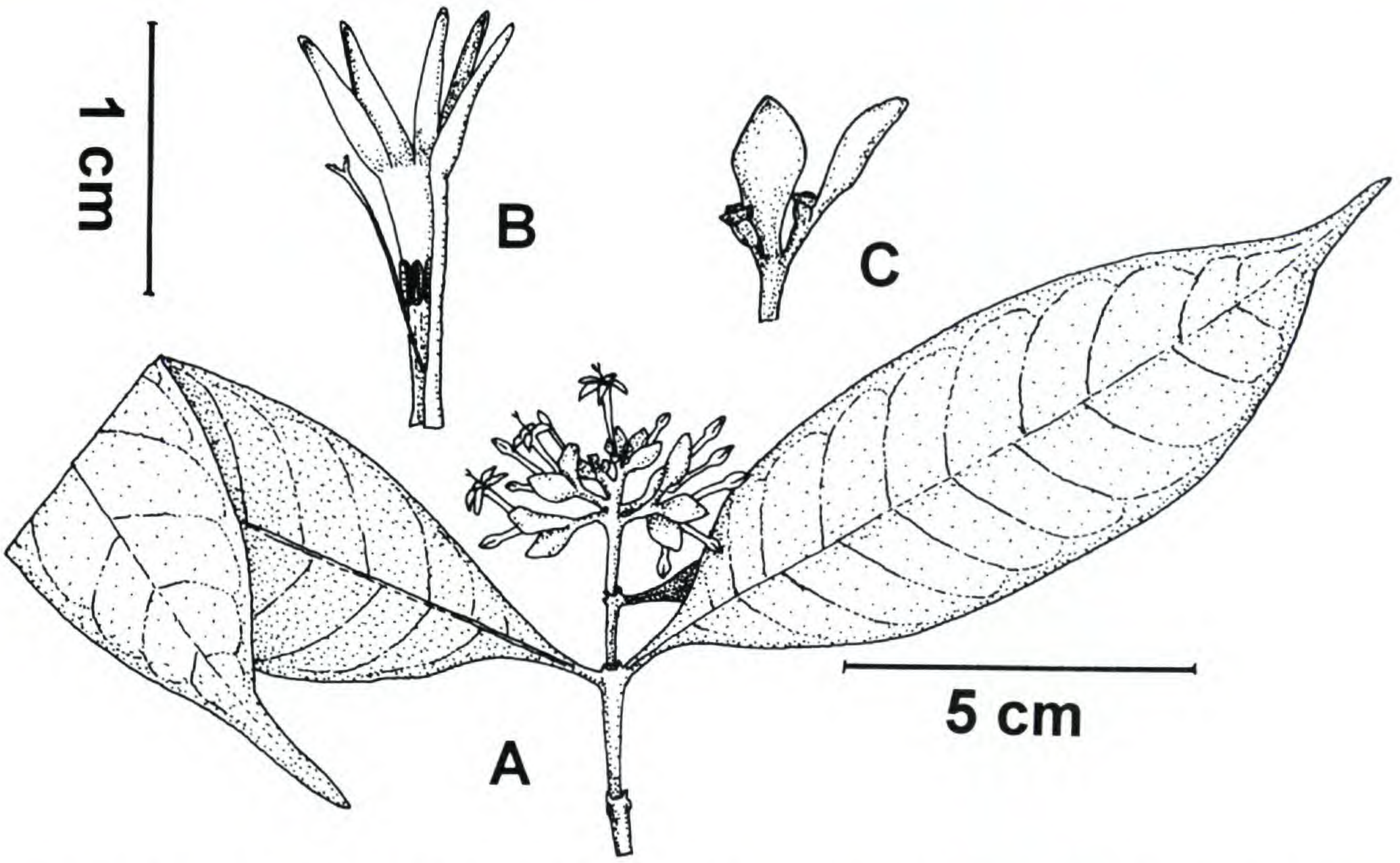

Figure 1. *Psychotria rhombibractea* C. M. Taylor & M. T. Campos, based on *Hopkins et al. 1483.* —A. Flowering branch. —B. Corolla and style of long-styled flower, partially dissected. —C. Cymule with bracts. B, C to 1-cm scale.

fruits February–April, June, and August. The common name is reported to be "mata-calado."

This new species is similar to *Psychotria officinalis* (Aublet) Sandwith, with which it has been confused; *P. officinalis* can be distinguished by its subulate to triangular bracts 4–7(–13) mm long, vs. elliptic, oblanceolate, or usually rhombic bracts 3–10 mm long in *P. rhombibractea*; corolla with the tube 2.5–3 mm long and lobes ca. 2 mm long, vs. the tube 9–10 mm long and lobes 5–8 mm long in *P. rhombibractea*; disc that is shorter than the calyx limb, vs. longer than the calyx limb in *P. rhombibractea*; and fruits 3 × 3–5 mm, vs. 4–6 × 6–8 mm in *P. rhombibractea.* The specific epithet of *P. rhombibractea* refers to the most common and distinctive form of the inflorescence bracts. The pyrenes of *P. rhombibractea* are relatively large, and their rugose surface is unusual.

Psychotria rhombibractea belongs to subgenus *Heteropsychotria* Steyermark, section *Pseudocephaelis* Steyermark (Steyermark, 1972); within this section, it appears to belong to Series B, "Pseudocephaelis."

Paratypes. BRAZIL. **Amazonas:** Reserva Florestal Ducke, Manaus–Itacoatiara road, Km 26, 02°53′S, 59°58′W, 8 fev. 1996 (fr), *Campos et al. 461* (INPA), 6 mar. 1996 (fr), *Campos & Pereira 536* (INPA, MO), 6 nov. 1961, *Rodrigues & Lima 3534* (INPA, NY), 9 jun. 1963 (fr), *Rodrigues & Freitas 5322* (INPA, NY), 23 ago. 1994 (fr), *Sothers & Silva 124* (INPA, MO); na beira da estrada para a torre, perto da placa de 0.5 km, 29 mar. 1996 (fr), *Campos & Silva 586* (INPA, MO); along path, 25 out. 1977 (fr), *Keel 189* (NY); próximo a Torre, 18 mar. 1991 (fr), *Mota & Santana 3* (INPA, MO); plantio do Pau Rosa na direção Acará, 14 jun. 1994 (fr), *Ramos 2826* (INPA, MO); à margem do caminho para o acampamento da Silvicultura, 5 jun. 1963 (fr), *Rodrigues 5254* (INPA, NY); perto da estação Meterológica, abr. 1973 (fr), *Rodriguez & Silva 9110* (INPA, MO); trilha a esquerda do Km 0.35 da estrada Alojamento–Torres, 11 mar. 1994 (fr), *Vicentini & Silva 418* (INPA, MO); próximo a torre de observação, trilha Torre-Acará, 12 nov. 1993 (fl), *Vicentini & Assunção 372* (INPA, MO).

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Carex tiogana (Cyperaceae), a New Sedge from the Sierra Nevada, California

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ABSTRACT. *Carex tiogana* is described as a new species in section *Capillares* from the Sierra Nevada, California, similar to *C. capillaris* but with culms usually shorter than or equal to the leaves, serrulate leaf midribs, conspicuous riblike veins on abaxial leaf surfaces, no enlarged vein at leaf margin, long prickles on leaf margins and pistillate scale midribs, perigynia fewer per spike and usually shorter, with longer prickles toward beak, usually shorter beaks, and shorter achenes.

A diminutive plant belonging to *Carex* sect. *Capillares* Ascherson & K. Graebner was discovered in the Tioga Pass region on the eastern border of Yosemite National Park, Mono County, California. No member of section *Capillares* has previously been reported from California (Mackenzie, 1922; Howell, 1959). The section includes two species known to occur in North America: *Carex capillaris* L. and *C. williamsii* Britton (Mackenzie, 1931–1935: 295–297). *Carex williamsii* is known only from calcareous substrates in the high Arctic, while *C. capillaris* is a widely distributed circumboreal plant often subdivided into a number of infraspecific taxa or segregate species on the basis of growth habit, leaf width, the sex of flowers in the terminal spike, spike length, and perigynium size (Packer, 1983; Porsild & Cody, 1980; Scoggan, 1978; Polunin, 1943; Komarov, 1935). These segregate taxa, here treated as subspecies, are *C. capillaris* subsp. *chlorostachys* (Steven) Löve, Löve & Raymond, *C. capillaris* subsp. *krausei* (Boeckler) Böcher, and *C. capillaris* subsp. *porsildiana* (Polunin) Böcher.

Carex tiogana D. Taylor & J. Mastrogiuseppe, sp. nov. [sect. *Capillares*]. TYPE: U.S.A. California: Mono County, headwaters of Parker Creek drainage, Mono Basin, along trail between Parker Pass and Koip Pass, Inyo National Forest (37°49′28″N, 119°11′25″W), 3260 m, 17 July 1988, *D. W. Taylor & K. A. Teare 9981* (holotype, UC; isotypes, COLO, NY, US). Figure 1.

Planta cespitosa; folia longiora culmis vel aequa, arcuata vel falcata, crassa, nervata abaxialiter, margines foliorum serrulatae, 8–12 aculei per mm, aculeus 0.1–0.14 mm longus, costa abaxialis serrulata. Squamae feminae costae serrulatae, 7–15 aculei per mm. Periginia 2–5(–8) per spicam, (1.2–)1.3–1.8(–1.9) mm longa, binervata, nervi serrulati versus rostrum, aculei 6–15, aculeus 0.05–0.2 mm longus; rostrum (0.1–)0.3–0.5(–0.7) mm longum ad achenium. Achenia 0.8–1.1 mm longa.

Perennial, densely caespitose in small clumps. Culms 1.7–6(–7.3) cm, shorter than or about equaling the leaves (occasionally slightly longer). Leaves generally clustered on the lower one-quarter of the culm, blades thick, stiff, bright green, arching to falcate, channeled along the midrib, (1.3–)1.7–6.5 cm × 0.9–2.2(–3) mm, with 3–5 prominent veins abaxially but without thick vein at margin, margins and midrib with 8–12 stiff prickles per mm, prickles 0.1–0.14 mm long. Inflorescence bracts with sheath 3–5 mm long, blade 4–26 mm long. Terminal spike staminate, 5–8 mm long; staminate scales straw-colored with yellow serrulate midrib. Pistillate spikes usually 2 or 3, 3–5(–7) mm long, on slender ± nodding peduncles 8–11 mm long; pistillate scales ovate, shorter and wider than perigynia, white-hyaline with green midrib, the apex rounded or with a short-apiculate extension of the midrib, midrib of at least some lower scales bearing 7–15 prickles per mm (0.025–)0.5–0.7 mm long, scales deciduous as perigynia mature. Perigynia (2–)5–8 per spike, obovate, (1.2–)1.3–1.8(–1.9) × (0.4–)0.7–0.9 mm, trigonous, glossy, body green to brown (chestnut), with usually two yellow-green ribs bearing 6–15 prickles toward the beak, prickles 0.05–0.2 mm long; beak (0.1–)0.3–0.5(–0.7) mm from tip to achene. Achene trigonous, 0.8–1.1 × 0.4–0.8 mm, filling perigynium body; stigmas 3. The plants are more vigorous when garden-grown (in Berkeley, California, and Moscow, Idaho) but are still small with culms shorter than to somewhat longer than the leaves and retain the other characteristic features (Table 1).

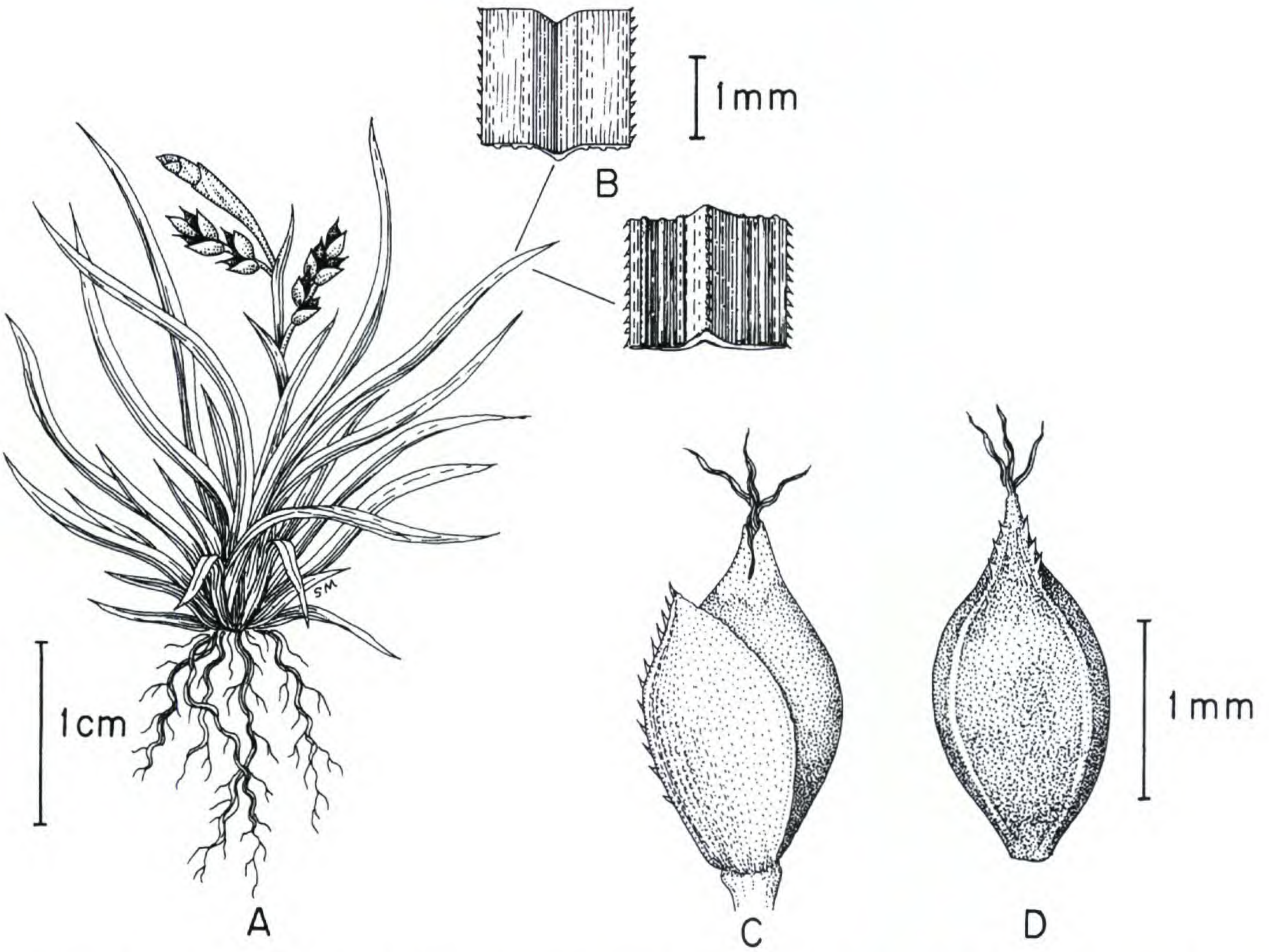

Figure 1. *Carex tiogana* D. Taylor & J. Mastrogiuseppe. —A. Habit. —B. Surfaces of leaf blade showing adaxial channeling, serrulate margins, abaxially riblike veins, and serrulate midrib. —C. Pistillate scale with perigynium (abaxial view). —D. Adaxial view of perigynium.

Carex williamsii is distinguished from the Sierran plants and from *C. capillaris* by having very narrow folded or involute leaves with 12–15 marginal prickles per millimeter and by perigynia usually having veins between the two ribs (Table 1). Characters distinguishing the subspecies of *C. capillaris* are listed in Table 1. The Sierran plants can be separated from *C. capillaris* without reference to geographic origin on the basis of culm length relative to leaves; leaf texture, venation, and prickles on midrib and margins; prickles on pistillate scale midribs; number of perigynia per spike; perigynium length, beak length, prickles, and stipe; and achene length (Table 1). Certain individual morphologic features of the Sierran plants occur in some populations of *C. capillaris*, but not in combination with other features characteristic of the Sierran plants.

The Sierran plant is currently known only from three small populations in Mono County, California, all beside lakes fed by glacial meltwaters and underlain by calcareous substrates. The clones of *C. tiogana* occupy small areas (no more than 400 m^2), making the species extremely vulnerable to human disturbance. *Carex tiogana* is both morphologically distinct and highly disjunct from other members of section *Capillares*. The closest stations are for *C. capillaris* subsp. *capillaris*, in the Ruby Mountains of east-central Nevada (Lewis, 1971)—400 km distant, and subspecies *chlorostachys* in the Wallowa Mountains of northeastern Oregon (Mason, 1975)—550 km distant.

Paratypes. U.S.A. **California:** Mono County, at the type locality, 10 Aug. 1986, *D. W. Taylor 8831* (UC, WS), 1 Aug. 1987, *D. W. Taylor 9198* (CAS, RSA, UC); marginal meadow at outlet of Cooney Lake, Virginia Lakes basin, Toiyabe National Forest (38°02′52″N, 119°17′01″W), 3102 m, 28 July 1988, *D. W. Taylor & K. A. Teare 9994* (UC, WS), 28 July 1988, *Glenn L. Clifton 18329* (PUA); turf bank at outlet of Upper Sardine Lake, Bloody Canyon, 3154 m, 24 July 1992, *D. W. Taylor 13061* (UC).

1a. Leaves 0.5–0.8 mm wide, most tightly folded or involute, margins with 12–15 prickles per mm . . . . . *Carex williamsii*

1b. Leaves 0.9–3 mm wide, most flat or shallowly channeled, margins with 0–12 prickles per mm.

2a. Culms usually longer than leaves, sometimes equaling leaves; leaf midribs abaxially smooth (occasionally serrulate at tip), prickles on leaf margins 0–0.08(–0.1) mm long; pistillate scale midribs usually without

Table 1. Comparison of the Sierran taxon with other members of *Carex* sect. *Capillares*.

	Sierran plants	*Carex capillaris* subsp. *capillaris*	subsp. *chlorostachys*	subsp. *krausel*	subsp. *porsildiana*	*Carex williamsii*
Growth habit	densely tufted	densely tufted	loosely tufted, rhizomatous	densely tufted	densely tufted	loosely tufted, rhizomatous
Leaf blades	thick, ± falcate	thick or thin, us. not falcate	thin, "grassy"	thick, not falcate	thick, occ. falcate	thick, not falcate
Leaf blade cross section	flat, shallow V, W	flat, shallow V, W	flat	flat, shallow V, W	flat, shallow V, W	folded or involute
Leaf blade width (mm)	0.9–2.2(–3)	(1.3–)1.7–2.2	1.4–2.4(–3)	1.6–2.5	(0.8–)1.3–1.8(–2.6)	0.5–0.8
Leaf veins thick, conspicuous abaxially	yes	no	yes or no	yes	no	no
Thicker vein at/near leaf margin	no	yes	us. yes	no	yes	yes
Leaf margin prickles/mm	8–12	0–11	(0–)5–11	8–10	0–12	12–15
Leaf margin prickle length (mm)	0.1–0.14	0–0.075(–0.1)	0–0.08(–0.1)	0.04–0.06	0.025–0.06(–0.1)	0.02–0.05
Leaf midrib serrulate abaxially (midlength)	yes	no	no	no	no (rarely toward tip)	no
Culm height (cm)	1.7–6(–7.3)	(2.5–)8.5–46	(10–)15–50	3–21	(2.5–)5–23	3–30
Culm height/leaves	≤(slightly >)	>	> to >>	> to >>	> (=)	> to >>
Terminal spike	staminate	usually staminate	staminate	gynaecandrous	gynaecandrous	staminate or androgynous
Pistillate scale midrib prickles/mm	7–15	0(–15)	0(–16)	0	0(–20)	0
Pistillate scale prickle length (mm)	(0.025–)0.05–0.07	0(–0.03)	0(–0.05)	0	0(–0.05)	0
Perigynia per spike	2–5(–8)	5–12	8–14	6–12	9–16	6–8
Perigynium length (mm)	(1.2–)1.3–1.8(–1.9)	(2–)2.3–4.1	(2.1–)2.5–4.2	2.3–3	(1.5–)1.8–2.8	2.1–4
Perigynium width (mm)	(0.4–)0.7–0.9	0.7–1.2	0.8–1.3	0.7–1	0.6–1.1	0.7–1
Perigynium nerves (in addition to 2 ribs)	0	0 (few)	0	0	0	0–6
Perigynium transition to beak	abrupt	abrupt or tapering	tapering	tapering	tapering	tapering
Perigynium beak length to achene (mm)	(0.1–)0.3–0.5(–0.7)	(0.3–)0.6–1.7	0.6–1.4	0.7–1	0.4–1	0.7–0.9
Perigynium prickle number	6–15	0–5	0–7	0	0–3	0
Perigynium prickle length (mm)	0.05–0.2	0–0.05(–0.1)	0–0.05(–0.1)	0	0–0.05(–0.09)	0
Perigynium stipe (mm)	0–0.2	0.2–0.4(–0.6)	0.4–0.6	0.4	0.3–0.5	0.2–0.5
Achene length (mm)	0.8–1.1	(1–)1.3–1.8	1.2–1.8	1.2–1.3	1–1.9	1.1–1.5
Achene width (mm)	0.4–0.8	0.65–0.95	0.8–1	0.6–0.8	0.5–0.8	0.5–0.9

prickles (occasionally bearing prickles up to 0.05 mm long); achenes 1–1.9 mm long . . . . . *Carex capillaris*

2b. Culms shorter than or about equaling leaves; midribs of at least some leaves abaxially serrulate at midlength, prickles on leaf margins 0.1–0.14 mm long; pistillate scale midribs with 7–15 prickles (0.025–)0.5–0.7 mm long; achenes 0.8–1.1 mm long . . . . . *Carex tiogana*

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Transfer of Four Peruvian *Altamiranoa* Species to *Sedum* (Crassulaceae)

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ABSTRACT. Recently *Altamiranoa* Rose (≡ *Villadia* sect. *Altamiranoa* (Rose) R. T. Clausen) was merged with *Sedum* L. For four Peruvian *Altamiranoa* species without valid names in *Sedum* we propose three new combinations: *Sedum decipiens* (Baker) Thiede & 't Hart, *Sedum reniforme* (H. Jacobsen) Thiede & 't Hart, and *Sedum weberbaueri* (Diels) Thiede & 't Hart, and one new name, *Sedum plicatum* Thiede & 't Hart. A lectotype is designated for *Cotyledon decipiens* Baker, the basionym of *Sedum decipiens*.

Rose (in Britton & Rose, 1903: 3) described the genera *Altamiranoa* Rose and *Villadia* Rose to accommodate some Mexican Crassulaceae with sympetalous flowers. Previously these species had mostly been classified in *Cotyledon* L., the hold-all of sympetalous Crassulaceae. Berger (1930) included both genera in subfamily Echeverioideae A. Berger, but noted that several *Altamiranoa* species are very similar to *Sedum*. Berger (1930) considered *Altamiranoa* and *Villadia* to be closely related though they differ in the structure of the inflorescences. *Altamiranoa* has predominantly cymose inflorescences, whereas those of *Villadia* are usually spicate, racemose, or, most frequently, thyrsoid. Fröderström (1936) more or less accepted Rose's concept, but transferred several *Altamiranoa* species to *Sedum*. Baehni and Macbride (in Baehni, 1937), on the other hand, united *Altamiranoa* and *Villadia*, and Clausen (1940) distinguished *Altamiranoa* as a section of *Villadia*. Baehni's and Clausen's classifications have been widely accepted until recently, when Moran (1996) merged *Villadia* sect. *Altamiranoa* (Rose) R. T. Clausen (≡ *Altamiranoa*) with *Sedum*. In particular the occurrence of intermediate forms bridging the gap between *Altamiranoa* and *Sedum*, and his doubts about the monophyly of *Villadia* in the sense of Baehni and Macbride and Clausen, prompted Moran's decision. Moran (1996) already made the necessary new combinations under *Sedum* for three Mexican *Villadia* (sensu lato) species. Here we complete the transfer of *Altamiranoa* to *Sedum* with three new combinations and one new name for four Peruvian species.

Sedum decipiens (Baker) Thiede & 't Hart, comb. nov. Basionym: *Cotyledon decipiens* Baker, Refug. Bot. 3, t. 200. 1870. *Echeveria decipiens* (Baker) E. Morren, Belgique Hort. 24: 159. 1874. *Altamiranoa decipiens* (Baker) Fröderström, Acta Horti Gothob. 10, App.: 145. 1936. *Villadia decipiens* (Baker) H. Jacobsen, Natl. Cact. Succ. J. 13: 76. 1958. TYPE: Peru. Sine loco, sine datum, *Farris s.n.* (holotype, not extant); Refug. Bot. 3, tab. 200. 1870 (lectotype, designated here).

The species is known only from the type collection and is as yet not validated by additional collections (Brunner, 1993: 376). No type material is extant at Kew (where J. G. Baker worked), at the British Museum (Baker described many species from specimens deposited at BM), or at Oxford (according to a note in the protologue Baker apparently obtained living specimens of Farris's collection via W. W. Saunders, whose herbarium is now kept at OXF). Therefore, we designate the excellent figure (tab. 200) accompanying the diagnosis as the lectotype of *Cotyledon decipiens* Baker.

Sedum plicatum Thiede & 't Hart, nom. nov. Replaced name: *Cotyledon stricta* Diels, Bot. Jahrb. Syst. 37: 410. 1906. *Altamiranoa stricta* (Diels) A. Berger, in Engler & Prantl, Nat. Pflanzenfam. ed. 2, 18a: 470. 1930. *Villadia dielsii* Baehni & J. F. Macbride, Candollea 7: 285. 1937 (nom. nov. pro *Cotyledon stricta* Diels due to *Villadia stricta* Rose, 1905). TYPE: Peru. Dep. Ancahs (Ancachs): pr. Caraz in rupestribus camporum, 2200–2500 m s.m., flor. m. Maj. 1903, *Weberbauer 3000* (holotype, B).

When *Cotyledon stricta* is transferred to *Sedum* neither the name *Sedum strictum* nor *Sedum dielsii* can be used, because of the earlier homonyms *Sedum strictum* K. Koch (1847) and *Sedum dielsii* Hamet (1913). The new name refers to the costately plicate petals mentioned by Diels in the original description of *Cotyledon stricta.*

Sedum reniforme (H. Jacobsen) Thiede & 't Hart, comb. nov. Basionym: *Villadia reniformis* H. Jacobsen, Natl. Cact. Succ. J. 13: 76. 1958 (nom. nov. pro *Cotyledon imbricata* Diels due to *Villadia imbricata* Rose, 1903). *Cotyledon imbricata* Diels, Bot. Jahrb. Syst. 37: 411. 1906. *Altamiranoa imbricata* (Diels) A. Berger, in Engler & Prantl, Nat. Pflanzenfam. ed. 2, 18a: 470. 1930. *Villadia imbricata* (Diels) Baehni & J. F. Macbride, Candollea 7: 286. 1937. Nom. illeg. (Art. 53.1 Tokyo Code, non *Villadia imbricata* Rose, Bull. New York Bot. Gard. 3: 3. 1903). TYPE: Peru. Dep. Cajamarca: pr. Hualgayoc, juxta praedim La Tahona in rupibus 2600 m s.m., flor. m. Maj. 1904, *Weberbauer 4053* (holotype, B).

When *Cotyledon imbricata* is transferred to *Sedum* the epithet of the second oldest name of this taxon, the synonym *Villadia reniformis* H. Jacobsen, must be used because of the earlier homonym *Sedum imbricatum* (Edgeworth) Walpers (1848–1849).

Sedum weberbaueri (Diels) Thiede & 't Hart, comb. nov. Basionym: *Cotyledon weberbaueri* Diels, Bot. Jahrb. Syst. 37: 411. 1906. *Altamiranoa weberbaueri* (Diels) A. Berger, in Engler & Prantl, Nat. Pflanzenfam. ed. 2, 18a: 470. 1930. *Villadia weberbaueri* (Diels) Baehni & J. F. Macbride, Candollea 7: 286. 1937. TYPE: Peru. Dep. Amazonas: Prov. Chachapoyas ad altera orientalia vallis fluminis Marañon supra Balsas in graminosis siccis 2300 m s.m., flor. m., Jun. 1904, *Weberbauer 4282* (holotype, B).

Acknowledgments. The authors are indebted to Urs Eggli (Zürich, Switzerland) and Reid Moran (Santa Rosa, U.S.A.) for their comments, to Susan Carter-Holmes (Kew, U.K.), Roy Vickery (London, U.K.), and Susan Marner (Oxford, U.K.) for checking specimens at K, BM, and OXF, and to Paul Hiepko and Manfred Bässler for providing access to specimens at B.

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Heterocentron evansii (Melastomataceae): A New Species from Pico Bonito National Park, Honduras

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ABSTRACT. *Heterocentron evansii*, known only from the higher slopes of Pico Bonito in northern Honduras, is described, illustrated, and compared with the species of subgenus *Schizocentron* to which it is here assigned. It is unique among congeners in having a combination of penninerved leaves, densely pubescent foliage and cauline internodes, glandular hairs on the prolonged connective of the larger anthers, and in occupying rocky ridgetops above tree line. This new species is the only *Heterocentron* restricted to Honduras and one of three species of Melastomataceae thought to be endemic to the country.

Heterocentron, with about 28 species, is one of two genera in the Melastomataceae with a distribution restricted to Mexico and Central America (Almeda, 1993). Since it has been the subject of a recent revision (Whiffin, 1972), *Heterocentron* has generally been regarded as one of the better known genera of neotropical Melastomataceae. Species of this family frequently colonize windswept ridgetops throughout the Neotropics, so it comes as no surprise that exploration of these sites continues to yield new and unusual taxa. Such is the case with the new species described below, which stands apart from all described species of *Heterocentron* by virtue of its copiously hirsute cauline indument and densely pubescent foliage. This, coupled with its apparent restriction to an exposed, rocky ridgetop on a previously unexplored mountaintop in the largest national park in Honduras, makes it especially notable. Like *Henriettella hondurensis* Wurdack and *Miconia celaquensis* Almeda, the other two species of Melastomataceae believed to be endemic to Honduras (Almeda, 1996), the affinities of *Heterocentron evansii* are with congeners restricted to montane areas of Guatemala and southern Mexico.

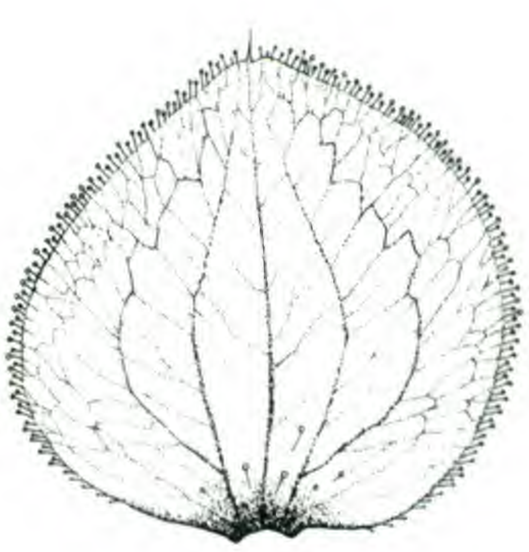
Heterocentron evansii Almeda, sp. nov. TYPE: Honduras. Atlántida: narrow crest of ridge leading up to Pico Bonito from the NE (from near confluence, at ca. 500 m elevation, of Río Bonito and a large quebrada flowing from the SW), 15°38′N 86°52′W, 1900 m, 23 Apr. 1996 (fl & fr), *R. J. Evans 2553* (holotype, CAS; isotypes, EAP, MEXU, MO). Figure 1.

Frutex humifusus, ramuli quadrangulati demum rotundato-quadrangulati sicut petioli foliorum venae primariae subtus hypanthiaque densiuscule setosi pilis plerumque 0.5–1 mm longis laevibus pro parte glanduliferis. Lamina 1.4–2.9 × 0.9–1.9 cm elliptica vel ovato-elliptica, penninervis, supra dense strigosa pilis laevibus 0.5–1 mm longis persistentibus, subtus dense strigosa pilis laevibus 0.5–1 mm longis. Flores 4-meri in axillis foliosis superioribus solitarii, pedicellis 1.6–2.6 cm longis. Stamina dimorphica; filamenta 7 mm vel 5 mm longa. Stamina maiora: thecae 4.5–5 × 0.5–0.75 mm; connectivum 2 mm prolongatum ad basim glandulis 0.25–0.5 mm stipitatis ca. 2 ornatum. Stamina minora: thecae 3 × 0.5 mm; connectivum ca. 0.1 mm prolongatum. Ovarium 4-loculare; semina 0.5 mm longa.

Low, procumbent, perennial subshrub with trailing branches to 1 m long and upright leafy axillary branchlets typically less than 8–9 cm in length. The quadrate to rounded-quadrate cauline internodes densely hirsute with spreading, smooth, brown hairs 0.5–1 mm long. Leaves of a pair essentially equal in size; petioles 3–12 mm long, densely hirsute like the

B

C



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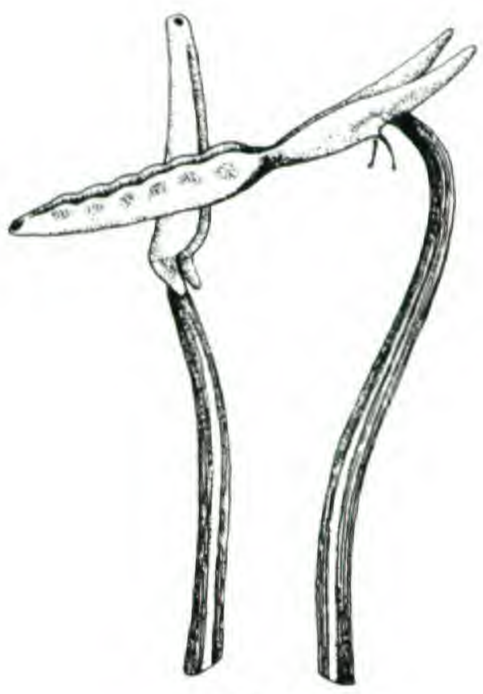

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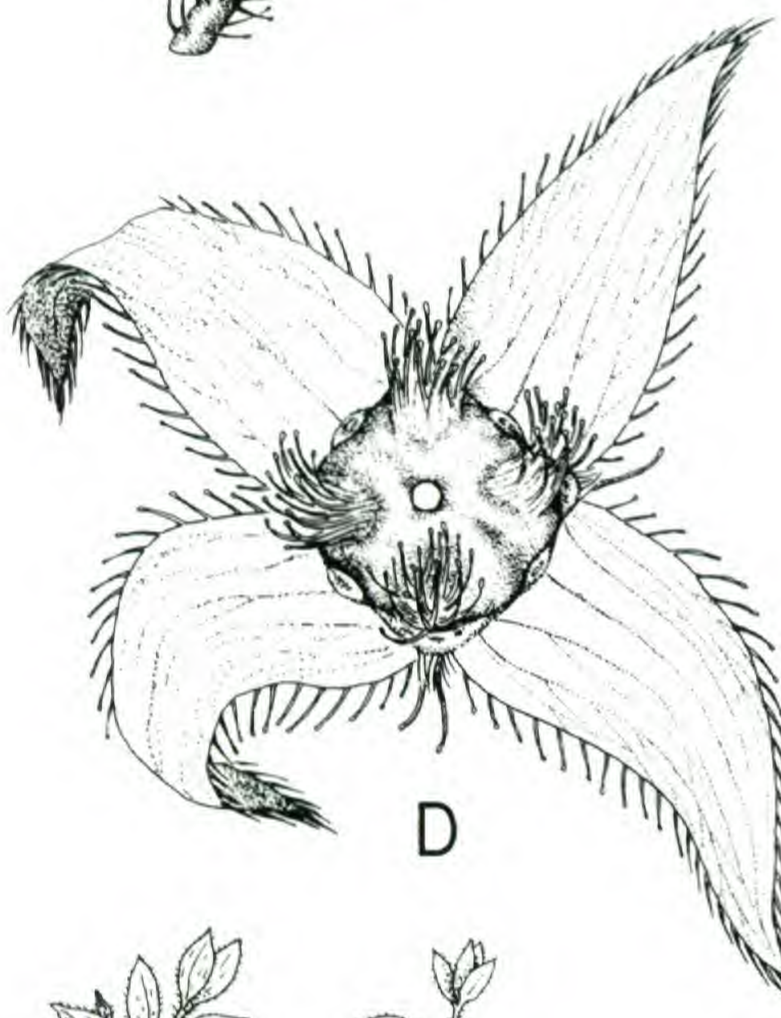

D

G

A

Figure 1. *Heterocentron evansii* Almeda. —A. Habit with enlargement of pubescence details at a node. —B. Representative leaf, abaxial surface. —C. Hypanthium and bibracteolate pedicel. —D. Hypanthium (top view) showing calyx lobes and ciliate scales on ovary summit. —E. Petal, abaxial surface. —F. Antepetalous stamen (left) and antesepalous stamen (right). —G. Seeds. Scale: for A, bar = 1.5 cm; for B, bar = 4.5 mm; for C, bar = 5 mm; for D, bar = 2.25 mm; for E, bar = 2.4 mm; for F, bar = 2.5 mm; for G, bar = 0.4 mm. (A–G from the holotype.)

cauline internodes; mature blades 1.4–2.9 × 0.9–1.9 cm, elliptic to elliptic-ovate, penninerved, abruptly acute at the apex, acute at the base, the margin entire to subentire, ciliate, adaxial surface densely covered with ± appressed, smooth hairs mostly 0.5–1 mm long, the abaxial surface also copiously but not as densely covered with antrorsely spreading, smooth hairs 0.5–1 mm long on and between the elevated veins. Inflorescence consisting of solitary flowers, sometimes crowded and appearing terminal or pseudoterminal on short ascending lateral branchlets. Pedicel 1.6–2.6 cm long, copiously covered with spreading glandular hairs mostly 0.25–0.75 mm long; bracteoles at the base of each pedicel sessile, 3–6 × 2–3.5 mm, ovate to cordate, acute at the apex, the margin entire; adaxially glabrous or with smooth appressed hairs ± restricted to the margins, abaxial surface sparsely to moderately strigose with smooth ± appressed hairs 0.5 mm long. Hypanthium (at anthesis) 5–6 × 4–6 mm, typically flushed with red like the calyx lobes, campanulate, copiously pubescent with spreading mostly glandular hairs 1–2.5 mm long. Calyx lobes 4, narrowly triangular, 7–8 × 2 mm, acute at the apex with a terminal, typically gland-tipped hair, glabrous adaxially and sparingly beset abaxially with a few appressed, simple (sometimes gland-tipped) hairs 0.25–0.5 mm long, the margin glandular-ciliate (in part). Petals 4, reportedly violet, 7–10 × 5–8 mm, glandular-ciliolate. Stamens 8, markedly dimorphic, differing in size and form, anther thecae glabrous, linear-oblong, yellow (fide label data on the type). Large (antesepalous) stamens: filaments glabrous, 7 mm long, thecae 4.5–5 mm long, 0.5–0.75 mm wide, ± horizontal to somewhat ascending; connective prolonged 2 mm below the thecae, modified ventrally at the filament insertion into a bifid appendage 1.5–1.75 mm long, the connective beset dorsally with two (rarely one) spreading glandular hairs positioned 0.25 mm above the filament insertion. Small (antepetalous) stamens: filaments glabrous, 5 mm long, thecae 3 mm long and 0.5 mm wide, erect, connective prolonged below the thecae ca. 0.10 mm and modified ventrally into a bifid appendage ca. 0.25–0.5 mm long. Ovary elliptic, glabrous but crowned with four ciliate scales surrounding the stylar scar. Style 8–10 mm long, declined to one side of the flower opposing the larger stamens. Fruiting hypanthium campanulate, 7–8 mm long to the torus and 5–6 mm wide with a somewhat pustulate or muriculate-tuberculate surface formed by the enlarged hair bases. Seeds cochleate and tuberculate, 0.5 mm long.

Distribution. Known only from the type locality on a dry, windswept ridgetop with thin, rocky soil and exposed outcrops above primary lower montane moist forest of *Pinus*, *Liquidambar*, and *Clusia* in Pico Bonito National Park in northern Honduras. This largest of Honduran parks, with 168,000 acres, protects an elevational range from near sea level to 8000 ft. (Wallace, 1992).

In the most recent taxonomic treatment of *Heterocentron*, Whiffin (1972) recognized two subgenera. *Heterocentron* subg. *Heterocentron*, which includes the majority of described species, is distinguished by its erect suffrutescent to subshrubby habit, penninerved leaves, few- to many-flowered, paniculate inflorescences, and white or pink (rarely purple) petals. For those species characterized by a procumbent suffrutescent to shrubby habit, trinerved (rarely penninerved) leaves, solitary flowers, and purple petals, Whiffin proposed the as yet unpublished subgenus "*Schizocentron.*" In this latter grouping he included *H. elegans* (Schlechtendal) Kuntze, *H. hirtellum* (Cogniaux.) L. O. Williams, *H. purpureum* S. Winkler, and *H. suffruticosum* Brandegee, all of which have patchy or restricted distributions in southern Mexico and/or northern Central America.

By virtue of its habit, inflorescence type, and petal color, *H. evansii* is here assigned with certainty to subgenus *Schizocentron.* It differs from other species in this subgenus by a diagnostic suite of characters that includes copiously hirsute cauline internodes, a dense foliar indumentum of smooth hairs, consistent presence of two (rarely one) glandular hairs on the prolonged connective of the larger anthers, and persistent pustulate or muriculate-tuberculate hair bases on fruiting hypanthia. Among the species enumerated above, *H. evansii* appears to be most similar to *H. suffruticosum* of Chiapas, Mexico, and adjacent Guatemala. These are the only two species in subgenus *Schizocentron* that share the penninerved leaves of subgenus *Heterocentron.* In other features, *Heterocentron suffruticosum* differs markedly from *H. evansii* in its erect or suberect habit, and in having appressed pubescent or subglabrous hypanthia and cauline internodes, basally roughened hairs on hypanthia and internodes, modally larger leaves (15–50 × 12–45 mm), and glabrous anther connectives.

The distinctly trinerved leaves of the other three species of subgenus *Schizocentron* readily set them apart. Only *H. elegans*, which also occurs in Honduras, has the habit and mostly glandular, spreading hypanthial hairs characteristic of *H. evansii.* In *H. elegans*, however, the trailing branches commonly root at the nodes, and the mature, ovate to oblong-ovate leaf blades are sparsely to moderately appressed-strigose on both surfaces. One other species, *H. hondurense* Gleason, is also recorded from Honduras. The

following key is provided to facilitate identification of the three species now known from that country.

KEY TO THE SPECIES OF *HETEROCENTRON* IN HONDURAS

1a. Flowers solitary; petals purple or deep magenta; southern Mexico, Guatemala, and Honduras.
  2a. Principal leaves trinerved with all primary nerves arising from a common point at the base of the blade; distal internodes sparsely to copiously covered with smooth, appressed hairs; southern Mexico (Hidalgo, Puebla, Veracruz, and Chiapas), Guatemala, and Honduras .... *H. elegans* (Schlechtendal) Kuntze
  2b. Principal leaves penninerved with the primary nerves diverging from the median nerve in subopposite to irregularly alternate fashion at successive points above the base of the blade; distal internodes densely covered with smooth, spreading hairs; Honduras ..... *H. evansii* Almeda
1b. Flowers borne in few- to many-flowered dichasia; petals white or pink; El Salvador, Honduras, and Nicaragua ..... *H. hondurense* Gleason

I take pleasure in naming this species for Randall J. Evans, collector of this and other noteworthy species of flowering plants in the course of his recent fieldwork in tropical America.

Acknowledgments. I thank Jenny Speckels for preparing the line drawings, Gerrit Davidse for tracking down duplicate collections at MO and having them dispatched to me in expeditious fashion, and Randall J. Evans for providing additional information on the type locality.

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Merger of the Monotypic Genus *Farringtonia* with *Siphanthera* (Melastomataceae)

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ABSTRACT. Phylogenetic studies based on morphological data show that *Farringtonia*, a monotypic genus originally placed in the Microlicieae but recently assigned to the Melastomeae, forms part of a small clade nested within the genus *Siphanthera*. Because these genera form a monophyletic group, *Farringtonia* and *Siphanthera* are merged and the new combination, *Siphanthera fasciculata*, is proposed.

The genus *Farringtonia* was established by Gleason (1952) for a single Venezuelan collection made by Julian A. Steyermark at the southeastern base of Cerro Duida in the state of Amazonas. In the protologue, Gleason suggested a close relationship between *Farringtonia* and *Siphanthera* Pohl based on such shared characters as 4-merous flowers and rostrate anthers. The distinctive features that, in Gleason's view, set *Farringtonia* apart from other melastome genera and species known to him at the time included its stoutly subulate anthers, large anther appendages, malpighiaceous cauline hairs, and fascicled *Empetrum*-like leaves.

In the course of preparing a monograph of *Siphanthera* we have conducted a comprehensive character analysis of *Siphanthera*, *Farringtonia*, and numerous possible sister genera in the Microlicieae and Melastomeae, the two tribes to which *Siphanthera* has been assigned (Gleason, 1952; Renner, 1993). Our phylogenetic studies of these genera using vegetative and reproductive characters provide consistent and unequivocal evidence that *Farringtonia* and *Siphanthera* form a monophyletic group, because *F. fasciculata* Gleason and *S. cordifolia* (Bentham) Gleason are sister taxa nested in a small clade within *Siphanthera*. Among the characters Gleason used to emphasize the generic distinctiveness of *Farringtonia*, only the apomorphic *Empetrum*-like leaves appear to be noteworthy in circumscribing the species, but none of these or any other characters have diagnostic value in the continued recognition of a monotypic genus. The malpighiaceous cauline hairs of *F. fasciculata* are very similar to those found in another, as yet undescribed species of *Siphanthera* from Amazonian Brazil. Thus, continued recognition of *Farringtonia*, a monotypic genus nested within a clade of the larger, diverse *Siphanthera* is inconsistent with our attempt to provide a phylogenetic classification.

The single species of *Farringtonia* is here transferred to *Siphanthera*, a monophyletic South American genus defined by a 4-merous flower, 2-locular ovary, and lacrimiform to vaguely reniform, areolate seeds. A description, distributional data, and habitat notes are included in our treatment of *Siphanthera* for the *Flora of the Venezuelan Guayana* and will be amplified in our forthcoming monograph (Almeda & Robinson, in prep.).

Siphanthera fasciculata (Gleason) Almeda & O. Robinson, comb. nov. Basionym: *Farringtonia fasciculata* Gleason, Fieldiana, Bot. 28: 426. 1952. TYPE: Venezuela. Amazonas: between Esmeralda Savanna and the southeastern base of Cerro Duida, 22 Aug. 1944, *Steyermark 57837* (holotype, F; isotypes, GH, NY, US).

Acknowledgments. We thank Paul E. Berry and Kay Yatskievych for their assistance in arranging, selecting, and dispatching a loan of *Siphanthera* from VEN via WIS and to the curators and staffs of the following herbaria for making material under their care available for study: A, BM, BR, C, CAS, DS, F, G, GH, GOET, HB, INPA, K, LAM, LE, M, MG, MO, NY, P, R, RB, S, SP, U, UB, UEC, US, W.

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Twisselmannia (Brassicaceae), a Remarkable New Genus from California

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ABSTRACT. *Twisselmannia californica*, a new genus and species from Kings County, California, is described and illustrated. Its relationships to other mustard genera are discussed.

To the foreign reader, the discovery of a new genus from the United States would seem rather unusual, especially for a family like the Brassicaceae (Cruciferae), which has recently been treated for North America in the outstanding monograph by Rollins (1993). Although most of the North American flora north of Mexico is well known, numerous discoveries continue to be made, and it is estimated that several hundred new taxa remain to be discovered and named from the United States alone (Ertter, in press; Milius, 1999). Hartman and Nelson (1998) indicated that 1197 new taxa of vascular plants, including five genera based entirely on newly described species, were discovered in the United States and Canada between 1975 and 1994. Of these, 91 taxa belong to the Brassicaceae, and 217 (ca. 18%) were discovered from California alone. Recent outstanding discoveries in the Brassicaceae from California include the new genus and species *Sibaropsis hammittii* S. Boyd & T. S. Ross (Boyd & Ross, 1997) and *Arabis hirshbergiae* S. Boyd (Boyd, 1998).

The remarkable new discovery, hereafter known as *Twisselmannia californica*, is based on a single specimen collected in 1994 and was nearly passed over by its collector as the common weed *Capsella bursa-pastoris* (L.) Medikus (Andrew Sanders, pers. comm.). It was sent initially to Reed C. Rollins who for reasons of deteriorating health never had the time to study it. The specimen, along with many others left in Dr. Rollins's office after he died, were loaned to me in November 1998. Upon a casual look at the specimen, it was immediately evident that it does not belong to any known genus in the Brassicaceae. Critical further study, as well as a thorough checking of Schulz (1936) and all the major floras of the world, supported the fact that the plant is a native new species that belongs to an undescribed monotypic genus. The saltbush scrub habitat in which *T. californica* grows belongs to a private property of ca. 1700-acre parcel land in Kings County that is up for development into an "instant city," an action that would have resulted in the total destruction of the habitat (Andrew Sanders, pers. comm.) and perhaps the extinction of the species. It was planned that I and several colleagues would look for *T. californica* in late February 1999 before I formally described it. However, due to the drought this year in that part of California and because of the immediate need to protect the habitat in which it grows, it became necessary to publish a formal account without delay.

The genus, anecdotally referred to as the Kings Gold, is named in honor of Ernest C. Twisselmann (1917–1972), rancher and tireless botanical explorer of the arid lands of south-central California, whose name is synonymous with floristic works on the Inner South Coast Ranges. His initial attempt to compile a simple list of the plants on the Twisselmann family ranches culminated in "A flora of the Temblor Range and the neighboring part of the San Joaquin Valley," all potential habitat for additional populations of *Twisselmannia*. He subsequently authored "A flora of Kern County, California." His floras (Twisselmann, 1956, 1967) continue to inspire several of the most enthusiastic floristicians in California.

Although the opportunity to honor Ernest Twisselmann with his own genus could not be passed by, credit must also be given to the discover, Ed LaRue, whose keen-sighted recognition of this anomalous mustard resulted in the fortuitous collection of the sole specimen currently known.

Twisselmannia Al-Shehbaz, gen. nov. TYPE: *Twisselmannia californica* Al-Shehbaz.

Herba annua; folia caulina pinnatisecta; racemi ad apicem bracteati, valde elongati; sepala oblonga, nonsaccata; petala lutea; stamina 6, tetradynama; fructus obdeltoidei, valde compressi, puberuli, valvis in dimidio inferiore carinatis, laevibus et tenuiter coriaceis, in dimidio superiore rotundatis, tuberculato-rugosis et crasse coriaceis vel sublignosis; septum valde angustatum; semina 4–8, oblonga, nonmucilaginosa; cotyledones incumbentes.

Herbs annual. Trichomes unicellular, eglandular, simple and minutely forked. Stems erect, few

branched basally. Basal leaves not seen; cauline leaves short petiolate, not auriculate, pinnatisect. Inflorescences many-flowered, somewhat dense racemes, bracteate to their apices, elongated considerably in fruit; rachis straight; bracts similar to cauline leaves, progressively smaller upward. Fruiting pedicels rather slender, terete, ascending-divaricate. Sepals oblong, deciduous, erect, glabrous, base of inner pair not saccate, margins narrowly membranous. Petals yellow, slightly longer than sepals, oblanceolate-obovate, apex rounded; claw obscurely distinct from blade. Stamens 6, tetradynamous; filaments filiform, dilated at base; anthers ovate, obtuse at apex. Nectar glands confluent, narrowly subtending bases of all stamens. Ovules 4–8 per ovary. Fruit dehiscent silicles, obtriangular, strongly flattened and angustiseptate, sessile; valves veinless, puberulent with simple and forked hairs, keeled, thin leathery and smooth on proximal half, rounded, thick leathery or subwoody, and tuberculate-rugose distally, wingless; gynophore absent; septum complete, very narrow; style slender, persistent, glabrous; stigma capitate, entire. Seeds 2–4 per locule, uniseriate, wingless, oblong, plump; seed coat minutely reticulate, not mucilaginous when wetted; cotyledons incumbent.

Twisselmannia californica Al-Shehbaz, sp. nov. TYPE: U.S.A. California: Kings County, S of Kettleman City, E side of Interstate Hwy. 5, 3 mi. N of the Kern County line, grazed valley saltbush scrub with *Atriplex confertifolia*, *Frankenia salina*, *Astragalus oxyphysus*, *Bromus hordeaceus*, *Deschampsia danthonioides*, and *Hordeum depressum*, 30 Mar. 1994, *Ed LaRue s.n.* (holotype, UCR). Figure 1.

Herba annua; caules 7–25 cm longi, pilosi, trichomatibus ad usque 1.5 mm longis; folia caulina et bracteae petiolatae, pilosae, pinnatisectae, lobis lateralibus oblongis vel oblongi-linearibus, 2–8 × 0.5–2 mm, integris; sepala oblonga, 1.2–1.5 × 0.7–0.9 mm; petala lutea, oblanceolato-obovata, 1.6–2.1 × 0.7–0.9 mm; pedicelli fructiferi tenues, pilosi, inferiores ca. 28 mm longi, superiores ca. 3 mm longi; fructus 4–5 × 4–5 mm, puberuli, trichomatibus 0.1–0.25 mm longis; replum anguste lineare, 4–5 × 0.3–0.4 mm; stylum 0.3–0.9 mm longum; semina oblonga 1.2–1.5 × 0.6–0.9 mm.

Herbs annual. Stems 7–25 cm tall, slender, erect, terete, pilose throughout with simple trichomes to 1.5 mm long. Basal leaves not seen; cauline leaves petiolate, pilose as on stem; petiole ca. 1 cm long, shorter upward; leaf blade 2.5–4.5 cm long, pinnatisect; lateral lobes 2–4 on each side, oblong to oblong-linear, 2–8 × 0.5–2 mm, entire; terminal lobe 1.5–2× larger than lateral ones. Fruiting racemes bracteate throughout, elongated considerably; bracts similar to cauline leaves, gradually reduced in size upward. Sepals oblong, 1.2–1.5 × 0.7–0.9 mm, glabrous, narrowly membranous at margin. Petals yellow, oblanceolate-obovate, 1.6–2.1 × 0.7–0.9 mm, cuneate into a short claw. Filaments white, median pairs 1.2–1.4 mm long, lateral pair 0.9–1 mm long; anthers ovate, 0.3–0.4 mm long. Fruiting pedicels divaricate-ascending, slender, pilose, lowermost to 28 mm long, uppermost to 3 mm long. Fruit a silicle, 4–5 × 4–5 mm, strongly angustiseptate, obdeltoid, veinless, puberulent with simple and minutely 1-forked trichomes 0.1–0.25 mm long; valves strongly keeled, smooth, and thin leathery on lower half, rounded, tuberculate-rugose, and thick leathery to subwoody on the outer part of distal half, minutely ciliate near margin along line of attachment to replum; replum narrowly linear, 4–5 × 0.3–0.4 mm; septum to 0.1 mm wide; style slender, 0.3–0.9 mm long. Seeds 2–4 and in upper half of each locule, oblong, brown, 1.2–1.5 × 0.6–0.9 mm.

Although the fruit shape of *Twisselmannia* somewhat resembles that of *Capsella* Medikus, the two genera are quite different in many characters. *Capsella* has stellate trichomes, ebracteate inflorescences, auriculate cauline leaves, smooth, distinctly veined, and thin fruit valves, and up to 40 seeds per fruit. By contrast, *Twisselmannia* has simple and minutely 1-forked trichomes, bracteate inflorescences, nonauriculate cauline leaves, tuberculate-rugose, veinless, and thick fruit valves, and up to 8 seeds per fruit.

Because of its pinnatisect leaves and thick, tuberculate-rugose, angustiseptate fruit valves, *Twisselmannia* bears some resemblance to *Coronopus* Zinn. *Coronopus* differs in having ebracteate inflorescences, 2-seeded fruits, completely closed valves, rudimentary septum, and exclusively simple trichomes, whereas *Twisselmannia* has bracteate inflorescences, 4–8-seeded fruits, open valves, distinct (though narrow) septum, and simple and forked trichomes.

Both *Capsella* and *Coronopus* are represented in North America by introduced weeds, and these genera are definitely unrelated to *Twisselmannia*. None of the New World Brassicaceae genera appears to be closely related to *Twisselmannia*, and the remarkable fruit morphology (with valves thin leathery, keeled, and smooth on the lower half and thick leathery or subwoody, rounded, and tuberculate-rugose on the upper) clearly sets it apart from all genera of the family. *Twisselmannia* is perhaps related to *Mancoa* Weddell, a genus of about ten species distributed in Texas, Mexico, and dis-

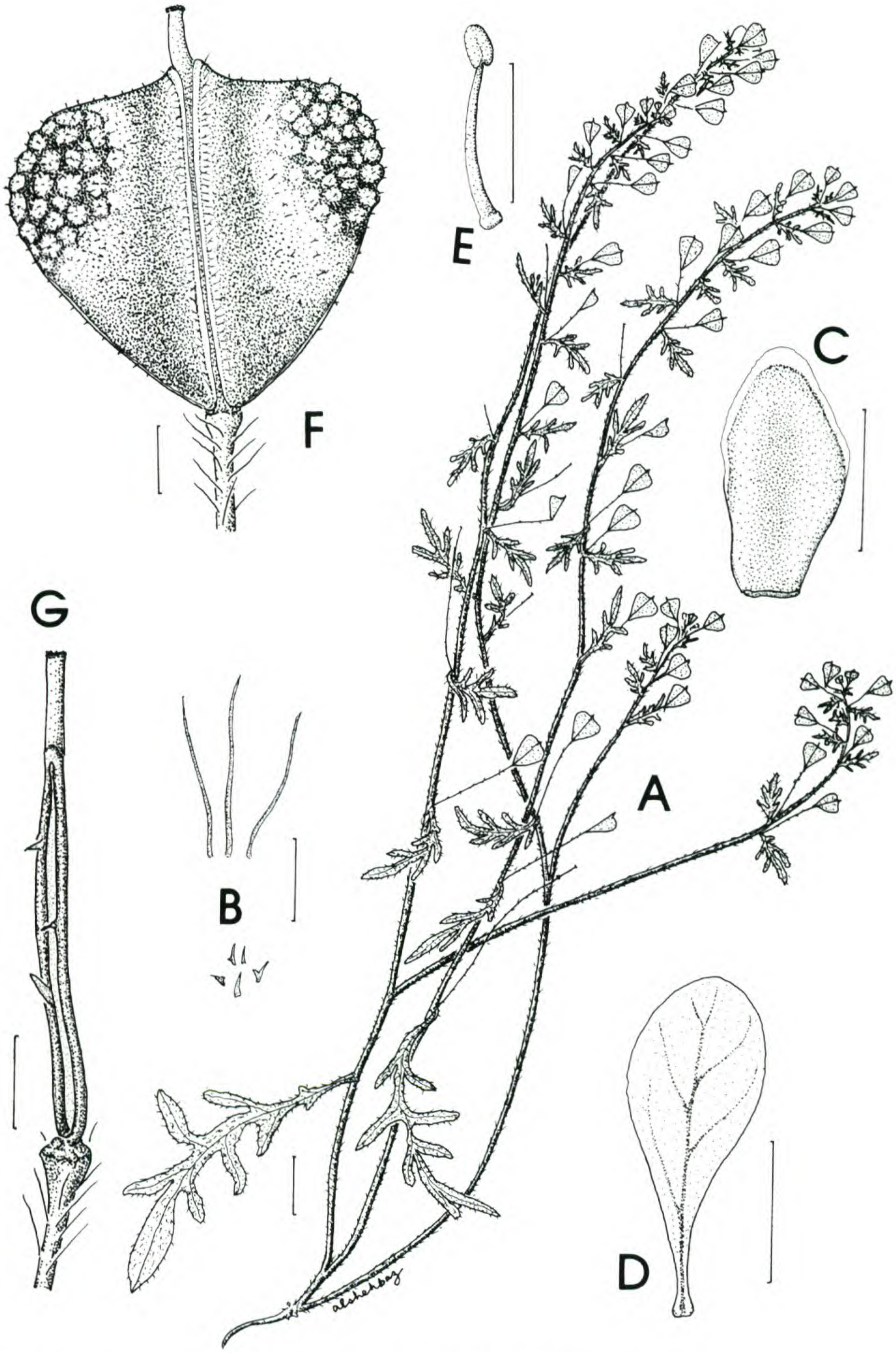

Figure 1. *Twisselmannia californica* Al-Shehbaz. —A. Plant. —B. Trichomes: long ones of leaves, stems, and pedicels; short ones of fruit valves. —C. Sepal. —D. Petal. —E. Stamen. —F. Fruit. —G. Fruit after removal of valves and seeds. Scale: A = 1 cm; B–G = 1 mm. Drawn by Al-Shehbaz from the holotype.

junctly into South America (Argentina, Bolivia, Peru). However, the differences between these two genera are substantial. *Mancoa* has oblong fruits, papery, smooth, rounded, readily dehiscent, and widely opened valves, biseriate seeds (15–)40–100 per fruit, filiform and long funicles, and broad replum to 2.5 mm wide. *Twisselmannia* has obtriangular fruits, leathery, distally tuberculate-rugose, basally keeled, tardily dehiscent, and nearly closed valves, uniseriate seeds 4–8 per fruit, stout and short funicles, and narrow replum to 0.4 mm wide.

Other genera with angustiseptate fruits, which are widely distributed in California, the adjacent southwestern U.S., and Mexico, include *Dithyrea* Harvey and *Dimorphocarpa* Rollins, but these are readily distinguished from *Twisselmannia* by their didymous fruits, 1-seeded valves, ebracteate inflorescences, decurrent stigmas, dendritic trichomes, obsolete septum, and undivided leaves (for comparison, see Rollins, 1979).

Acknowledgments. I am grateful to Henk van der Werff for correcting the Latin. I thank Peter H. Raven, Andrew Sanders, Emily Wood, and Kathryn Rollins for help and support. I am much indebted to Barbara Ertter for suggesting the generic name and for providing information on E. C. Twisselmann.

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Note added in proof. Dean Wm. Taylor and Barbara Ertter are thanked for making a special effort to re-collect *Twisselmannia californica.* Their search for the plant in the type locality and five other sites on 25 March 1999 resulted in the discovery of several small plants in an area of perhaps two square meters in association with *Atriplex spinifera*, not *A. confertifolia*, as stated in the collection data of the holotype. Of these, only a few plants were collected, and they represent the following paratypes:

CALIFORNIA. San Joaquin Valley, Kings County, ca. 13 miles S of Kettleman City, along pipeline access road lying 0.3 mi E of Interstate 5, at a point along the freeway 3.1 road mi. N of Kern County line, 217 ft. alt., T24S R20E SE1/4 NE1/4 Section 22, 35°49′41″N, 119°48′16″W, West Camp 7 1/2′ USGS quadrangle, subalkaline, sandy clay in *Atriplex spinifera* scrub, flowers yellow, 25 Mar. 1999, *Dean Wm. Taylor 17098 & Barbara Ertter* (MO, UC).

Adenocalymma ubatubensis Assis & Semir, a New Species of Bignoniaceae from Ubatuba, São Paulo State, Brazil

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ABSTRACT. *Adenocalymma ubatubensis*, a new species from southeastern coastal Brazil, is described and illustrated. The species is distinguished by its large pseudostipules and calyx without nectaries.

Adenocalymma is the second largest genus of the tribe Bignonieae (Bignoniaceae), with ca. 50 species in tropical America. Most species have a restricted distribution, and in a recent study (Gentry, 1993) six new species were described from eastern South America.

A study of recent collections of *Adenocalymma* for the "Flora Fanerogâmica do Estado de São Paulo" project revealed a distinct new species related to *A. hatschbachii* A. H. Gentry and *A. ackermanii* Bureau & K. Schumann. The new species and *Adenocalymma hatschbachii* occur in the Atlantic rainforest of southeastern coastal Brazil, while *A. ackermanii* is known only from the type collected in Minas Gerais state.

Adenocalymma ubatubensis Assis & Semir, sp. nov. TYPE: Brazil. São Paulo: Ubatuba, Picinguaba, 9 May 1990 (fl), *R. Romero et al. 74* (holotype, HRCB; isotypes, MO, SP, UEC). Figure 1.

Scandens, ramis junioris dense tomentosis, glabrescentis, pseudostipulae magnae foliaceae. Folia bifoliolata, interdum cirrho simplici, foliola ovato-oblonga vel subelliptica, apice acuto vel acuminato, base rotundata, subcordata, supra subvillosa tandem glabrata, subtus densa subvillosa, pilosa, pilis simplicibus vel ramosis. Inflorescentiae axillares racemosae, bracteis et bracteolis tomentosis et eglandulosis. Flores calyce campanulatos extus tomentosos, eglandulosos, corolla campanulata, lutea, basi glabra, supra dense tomentosa, stamina inclusa. Capsula ignota.

Lianas, branchlets densely tomentose when young, soon glabrate when older, without interpetiolar nectaries (glandular fields), lenticellate; the two basal leaflets of each leaf forming pseudostipules, 1.1–3.5 × 0.4–1.4 cm, persistent in inflorescence base, elliptic, obovate-elliptic to spatulate, acute to slightly rounded, mucronulate, base attenuate, enlarged, both faces tomentose, with venation subparallelodromous to mixed craspedodromous, 5–7 main nerves raised below, few inconspicuous nectaries. Leaves 2-foliolate, the terminal leaflet replaced by a simple tendril; petioles (1.2–2.6 cm) and petiolules (0.6–4 cm) tomentose to subvillose; blades 5.5–17.5 × 2–6.7 cm, ovate-oblong to subelliptic, apex acute to shortly acuminate, base rounded to subcordate, margin slightly revolute, intramarginal vein inconspicuous, chartaceous, tomentose, subglabrate, scabridulous and subpilose above, muriculate on nerves, venation gradually raised, densely tomentose to subvillose below, simple or forked slightly uncinate trichomes, few punctate, nerves raised. Inflorescence ca. 10 cm, axillary, racemiform to subcorymbiform; bracts and bracteoles 7–10 × 2–4 mm, tomentose, without nectaries. Flowers yellow, calyx 1.3–1.5 × 0.7 cm, margin 5-denticulate, nerves raised above, thick, tomentose outside, without nectaries, papillose inside; corolla 5–6 cm, infundibuliform, basal tube (ca. 1.5 cm) glabrous, toward apex densely tomentose outside, lobes ca. 1.5 cm, subtomentose faces, inside at the level of stamen insertion with glandular trichomes; stamens included, longest pair 1.7–2.6 cm, shortest pair 0.5–1.9 cm, anthers 4 mm long, with thecae divergent; ovary oblong, subtetragonal, glabrous or with scattered trichomes, simple or forked, punctate, glandular; the ovules biseriate in each locule, ca. 18 to series. Fruit not seen.

Distribution. Known only from the types collected in coastal plains (restinga) of northern São Paulo state.

Adenocalymma ubatubensis has a calyx without nectaries and long pseudostipules (1.1–3.5 cm long), densely tomentose and with conspicuous nerves raised, more or less parallel, that differentiate this new species from all species circumscribed in the genus. Two related species, *Adeno-*

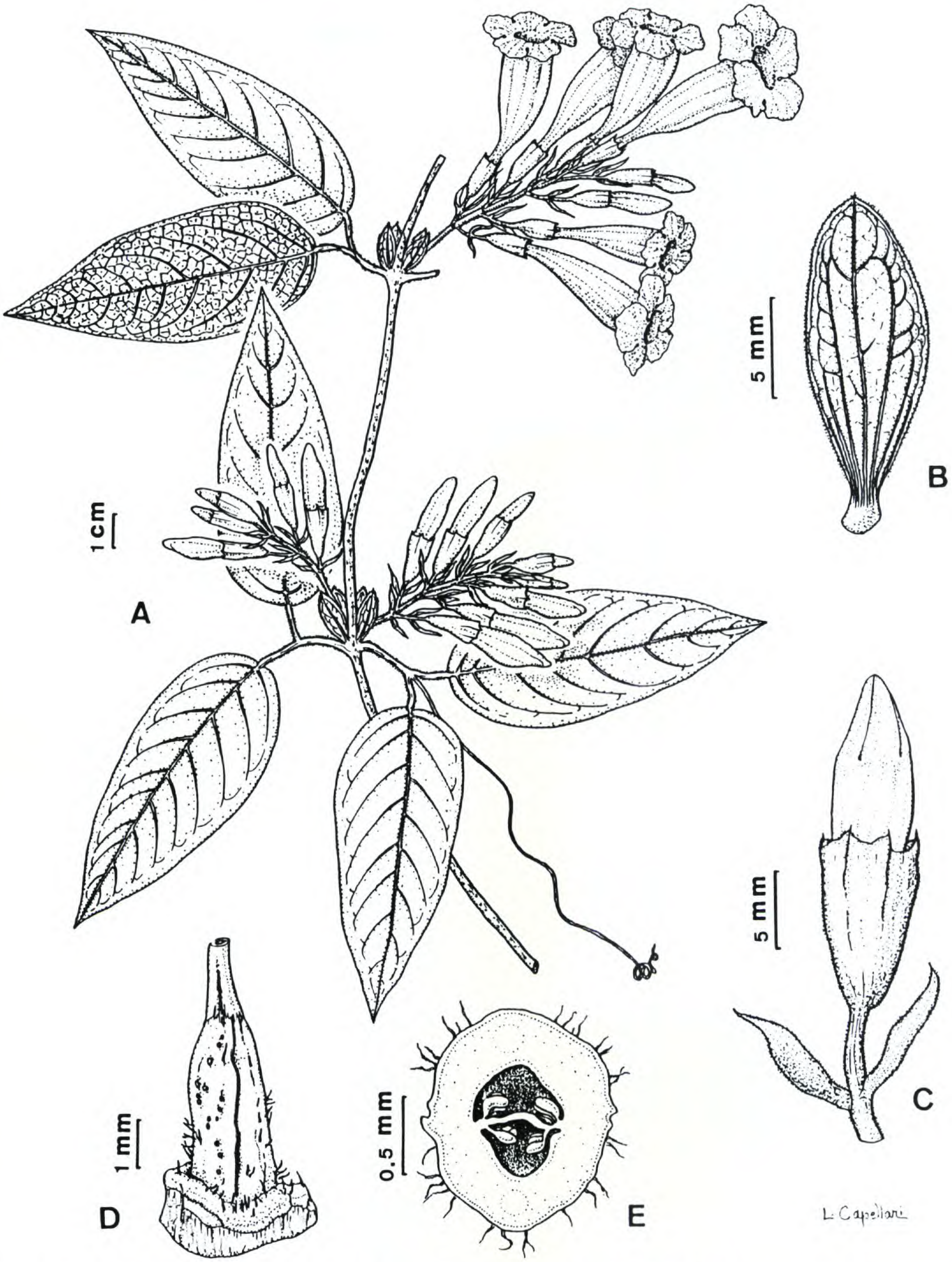

Figure 1. *Adenocalymma ubatubensis* Assis & Semir. —A. Flowering branch. —B. Pseudostipule. —C. Bud showing calyx and bracteoles without nectaries. —D. Ovary and disc. —E. Ovary cross section. (*R. Romero et al. 74.*)

calymma ackermanii and *A. hatschbachii*, also have eglandular calyxes. *Adenocalymma hatschbachii*, which also occurs in the Atlantic rainforest, differs in having smaller (5 mm), subulate, and non-tomentose pseudostipules (Gentry, 1993). Moreover, *A. hatschbachii* has membranaceous and only puberulous, long-acuminate leaflets, with stamens more or less exserted. The other species, *Adeno-*

calymma ackermanii, has a similar form of pseudostipules, but these are more acute and puberulous (Bureau & Schumann, 1896–1897). It also differs in the smaller leaflets and in the fewer number of ovules in the locule (only 26).

Another species with conspicuous pseudostipules is *Adenocalymma prancei* A. H. Gentry. However, the pseudostipules of that species are linear-oblong and measure up to 1.3 cm long (Gentry, 1978). It also differs in having a glandular calyx and in occurring in central and upper Amazonia.

Paratype. BRAZIL. **São Paulo:** Ubatuba, Picinguaba, 6 May 1988 (fl), *R. Costa et al. 14* (HRCB, UEC).

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Three New Species of *Huberia* (Melastomataceae) from Peru

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ABSTRACT. Three new Andean species of the genus *Huberia* DC. are described and illustrated. These species were found between 1500 and 3350 m in restricted areas of northwestern Peru. The presence of staminodes in *H. staminodia* represents a new record for this floral structure for *Huberia*. A key is also provided for the four species of *Huberia* occurring in the Andean region: *H. cogniauxii*, *H. peruviana*, *H. staminodia*, and *H. weberbaueriana*.

Huberia DC. is a neotropical genus of 16 species, the majority of which occur in eastern Brazil. Only one species, *H. peruviana*, was known to occur in Andean Ecuador and Peru. During a recent taxonomic revision of this genus (Baumgratz, 1997), species new to science were discovered, of which three, *H. cogniauxii*, *H. staminodia*, and *H. weberbaueriana*, from the Peruvian Andes are described, illustrated, and mapped (Fig. 1).

Huberia staminodia Baumgratz, sp. nov. TYPE: Peru. Depto. Amazonas: Province of Bongará, between río Utcubamba and Shipasbamba, 4 km from Campomiento Ingenio, altitude 1520 m, 2 Feb. 1964, *P. C. Hutchinson & J. K. Wright 3995* (holotype, NY; isotypes, F, K, US, USM). Figure 2.

Frutices ca. 1 m alta, indumento glanduloso-furfuraceo etiam gemmis vegetativis glanduloso-vilosis; ramis tetragonis. Folia membranacea, anguste ovata vel elliptica, trinervia, margine integra vel apice crenata; domatia petiolaria tubulosa interdum leviter inflata. Flores saepe 4-meri, interdum 5-meri, hypanthio 8-anguloso, interdum 10-, calycis laciniis aequi-inaequilongisve, anguste triangularibus; petalis ellipticis vel angusto-obovatis, apice acutis, staminibus fertilibus et staminodiis, loculis antherarum sinuatis. *Huberia staminodia* affinis *H. peruvianae*, *H. weberbauerianae* et *H. cogniauxii* sed praesertim staminodiis praesentibus differt.

Shrub ca. 1 m high; branches, leaves, inflorescences, bracts, prophylls, pedicels, hypanthium, and calyx glandular-furfuraceous, the vegetative shoots and their adjacent axillary regions also glandular-villous. Branches quadrangular, gray and sulcate, brownish when young. Petioles 0.5–1.5 cm long, the apex with one pair of tubular domatia, sometimes slightly inflated. Leaf blades 2.5–6.4 × 1.2–2.4 cm, membranaceous, narrowly ovate to elliptic, the base acute, the apex acute-acuminate, the margin entire or basal ⅔ entire and distal ⅓ crenulate, 3-nerved with the lateral veins arising at the base, the central secondary veins 10–13 pairs, transverse to oblique-ascendant. Inflorescences terminal, sessile, cymoids (Troll, 1969), corymbose or not, 2.5–3.5 cm long, with 15–25 flowers, the branches 2(–4), as triads or sometimes umbelliform cymes with 5 flowers, distal node a triad or umbelliform cyme with 9 or 13 flowers; bracts 2–21 × 0.5–9.0 mm, foliaceous, petiolate to sessile, membranaceous to thickened, ovate to elliptic or linear, slightly concave, the apex acute to obtuse, the margin entire or sometimes distal ⅓ crenulate; prophylls 1–2, 1–3 × 0.2–0.5 mm, thickened, oblong to linear. Flowers 4(–5)-merous; pedicel 6.0–7.5 mm long, obtusely quadrangular; hypanthium 3.1–4.0 × 2.0–2.5 mm, tubular, 8-angled, the apex slightly constricted; calyx lobes equal or unequal in size, (0.5–0.8)1.0–1.5 × (0.6–)0.8–1.1 mm, narrowly triangular, angled at abaxial surface, the base laminar, rigidly membranaceous, the apex thickened, subterete, oblong, rounded; petals white, 10–11 × 3.0–4.3 mm, elliptic to obovate, the apex acute; fertile stamens 4–5(6–7), unequal in size, antisepalous and/or antipetalous, yellow, the filaments 5.8–6.3 mm long, the anthers narrowly triangular, the base symmetric or asymmetrically lobed, the thecae 4.5–5.6 mm long, undulate, bilocular to pseudo-bilocular to the apex, the tube unilocular, 0.3–0.4 mm long, the connective appendage 1.5–2.1 mm long, dorsal, filiform, straight or zigzag-shaped, sometimes absent; staminodia (1–2)3–4, antipetalous, subisomorphic, yellow, 7.5–9.5 mm long, filiform, the apex subulate, sigmoid to sinuous or sometimes zigzag-shaped; ovary ⅘–⅞(–⅞) free, 3.8–4.0 × 2.0–2.1 mm, 4-locular, the ovules 1.1–1.3 mm long; style 12.0–12.5 mm long, subterete, the stigma punctiform. Fruit a ruptidium (a capsular fruit type; Baumgratz, 1997), 18–19 × 5.2–5.5 mm, the hypanthium and calyx persistent, urceolate, the apex slightly 8-angled, the pedicel 9–10 mm long; seeds 300–350, 2.2–4.0 × 0.4–0.7 mm, winged, linear to narrowly elliptic or ovate; embryo 0.4–0.7 mm long.

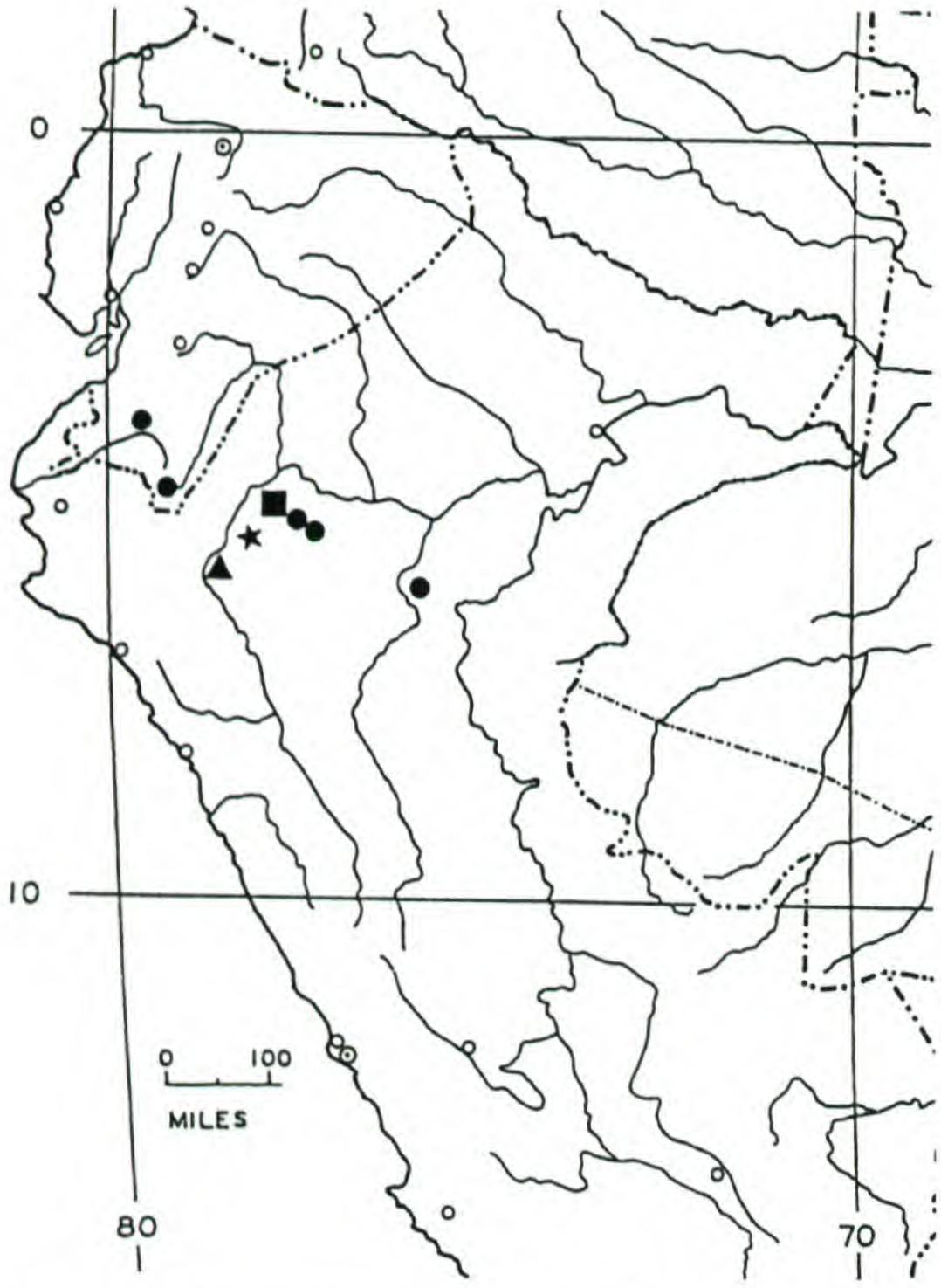

Figure 1. Geographic distribution of the Andean species of *Huberia* DC.: *H. cogniauxii* (▲), *H. peruviana* (●), *H. staminodia* (★), and *H. weberbaueriana* (■).

Distribution. *Huberia staminodia* is known only from the type collection. It is endemic to northwestern Peru, between the Utcubamba and Shipasbamba rivers, in the cloud forests of Cordillera Central or Oriental, Prov. Bongará, at 1520 m. This phytogeographic region is named Ceja de la Montaña, more precisely Ceja del Marañón, where the presence of clouds is observed throughout the year (Weberbauer, 1945). It is described by Young and León (1993) as a region of moist forest of the oriental slopes.

Huberia staminodia is unique in the genus because of its staminodia. The tubular domatia in the petioles and 5-merous flowers also distinguish this species from the other Peruvian species. The inflorescences are very condensed and short, with 15, 19, 21, and 25 flowers. The most frequent androecium pattern in the tetramerous flowers is five fertile stamens and three staminodia, but the proportion 4:4 and sometimes 6–7:1–2 is also encountered in the same specimen. In the pentamerous flowers the androecium has seven fertile stamens and three staminodia. In both types of flowers the staminodia are always antipetalous, alternating with the fertile stamens. As observed in all species of *Huberia*, the fruit is an interesting capsule type: it was termed a ruptidium by Baumgratz (1997). It is composed of the mature ovary and the urceolate hypanthium and calyx. In the mature fruit, it is necessary for the hypanthium and calyx to open by irregular dehiscence in order for the seeds to be dispersed; the mature ovary has loculicidal and septifragal dehiscence. Flowering and fruiting in February.

Huberia weberbaueriana Baumgratz, sp. nov. TYPE: Peru. Depto. Amazonas: Prov. Bongará, below San Carlos, 1700 m, June 1915, *A. Weberbauer 7145* (holotype, US; isotypes, F, GH). Figure 3.

Plantae indumento glanduloso-furfuraceo, gemmis vegetativis, petiolis et supra junioribus foliorum indumento glanduloso-vilosis ornatis; ramis tetragonis. Folia rigido-membranacea, anguste ovata vel elliptica, margine basi integro apiceque serrulato, trinervia. Domatia laminaria marsupiformia interdum junioribus foliis carentia. Flores 4-meri, hypanthio 8-anguloso, calycis laciniis anguste triangularibus, petalis oblongis vel ellipticis, stigma capitatis. *Huberia weberbaueriana* affinis *H. cogniauxii* sed praesertim marginalibus nervis secundariis in basi non confluentibus cum lateralibus nervis principalibus, floribus et fructibus longioribus, petalis apice acuto vel obtuso-apiculato, antherarum thecis manifeste sinuatis differt.

Plants with branches, leaves, inflorescences, bracts, prophylls, pedicels, hypanthium, and calyx glandular-furfuraceous, the vegetative shoots and their adjacent axillary regions, and the petioles and adaxial surface of the foliar blade when young also glandular-villous. Branches subquadrangular, striate when young. Petioles 0.6–1.1 cm long. Leaf blades 2.6–5.8 × 1.0–1.9 cm, rigidly membranaceous, narrowly ovate to elliptic, the base acute or sometimes obtuse, the apex acuminate, the basal margin ⅓ entire and distal ⅔ conspicuously to slightly serrulate, 3-nerved with the lateral veins arising at the base, the marginal secondary veins inconspicuous and confluent to lateral primary veins at the base, the central secondary veins 12–15 pairs, oblique-ascendant; abaxial surface with marsupiform laminar domatia, sometimes absent in young leaves, apiculate at border of the membrane. Inflorescences terminal, sessile, corymbose cymoids (Troll, 1969), 2.5–3.0 cm long, with 11–19 flowers, the branches 2–4, frequently as triads or sometimes umbelliform cymes with 4 flowers, distal node usually an umbelliform cyme with 5 flowers or sometimes a triad; bracts membranaceous, foliaceous, 9–23 × 1.5–10.0 mm, petiolate, narrowly elliptic, the apex acute, the margin entire or sparsely serrulate to the apex, or bracts thickened, 1.4–5.0 × 0.2–0.5 mm, sessile, oblong, slightly concave, the apex obtuse, the margin entire; prophylls

Figure 2. *Huberia staminodia* Baumgratz. —a. Flowering branches. —b, c. Details of petiolar domatia. —d. Transverse petiole sections at levels in c, illustrating the cavities of the domatia. —e. Flower. —f, g. Pedicel, hypanthium, and the calyx with four and five lobes, respectively. —h, i. Petals. —j, k. Fertile stamens. —l. Transverse anther sections at levels in j, illustrating loculi and septa. —m. Detail of the connective appendage. —n. Staminodium. —o. Longitudinal ovary section showing the partial adnation to the hypanthium. —p, q. Fruits. —r, s. Seeds.

Figure 3. *Huberia weberbaueriana* Baumgratz. —a. Flowering branches. —b. Detail of the foliar indument. —c–e. Details of the laminar domatia. —f. Transverse leaf base sections at levels in c, illustrating the cavities of the domatia. —g, h. Bracts: foliaceous and petiolate, and thickened and sessile, respectively. —i. Prophyll. —j. Flower. —k. Pedicel, hypanthium, and calyx. —l. Calyx lobe. —m, n. Petals. —o, p. Longer and shorter stamens, respectively. —q. Ovary. —r. Style.

1–2, 0.4–0.6 × 0.1–0.2 mm, linear. Flowers 4-merous; pedicel 9–11 mm long, quadrangular; hypanthium 5.5–6.2 × 2.5–3.0 mm, tubular, 8-angled, the apex slightly constricted; calyx lobes 1.5–1.9 × 0.5–0.6 mm, narrowly triangular, angled at abaxial surface, the base laminar, rigidly membranaceous, the apex thickened, subterete, oblong, rounded; petals white, 12–14 × 4.5–5.8 mm, oblong to elliptic, the apex acute to obtuse-apiculate; stamens of two sizes, yellow, the antipetalous stamens longer than the antisepalous, the filaments of the longer 6.0–6.8 mm long, of the shorter 5.2–6.1 mm long, the anthers narrowly triangular, the thecae of the longer 6.5–7.3 mm long, of the shorter 5.6–6.2 mm long, conspicuously undulate, bilocular to unilocular to the apex, the tube unilocular, 0.3–0.4 mm long, connective appendage 3.5–4.4 mm and 4.2–4.4 mm long, dorsal, filiform, straight or zigzag-shaped, the apex apiculate or sometimes asymetrically uni- or bi-apiculate; ovary ¾–⅞ free, 4.0–4.8 × 2.3–2.7 mm, 4-locular, the ovules 0.6–1.6 mm long; style 14–16 mm long, the stigma capitate. Mature fruit not seen; young fruit 17.0–17.5 × 2.8–3.0 mm, urceolate, 8-angled, the pedicel 9–10 mm long, striate.

Distribution. *Huberia weberbaueriana* is known only from the type collection. It is endemic to northwestern Peru, where it occurs near the city of San Carlos at 1700 m and in the same phytogeographic region as the other Peruvian species of *Huberia*. Given the altitude and based on the study of Young and León (1993), this new species may occur on the rainforest slopes of Ceja de la Montaña or in cloud forests situated in moist forest at higher elevations of the oriental slopes.

Huberia weberbaueriana may be distinguished from the other Andean species of *Huberia* by its marsupiform laminar domatia, longer size of the flowers, fruits and their pedicels, the stamens of two sizes, the thecae conspicuously undulate, and the stigma capitate. The long glandular hairs in the vegetative shoots and their adjacent axillary regions are early caducous and they may be obscured by a viscous substance in dried specimens. Usually each leaf has a pair of domatia, but some specimens have only one and on young leaves the domatia may not be observed. The inflorescences are condensed and short, with 11, 15, 17, and 19 flowers. This new species seems most closely related to *H. cogniauxii*, but the latter has leaves with marginal secondary veins confluent to the lateral primary veins above the base, shorter flowers and flower parts, and the thecae with its surface smooth to slightly undulate. Flowering and with young fruits in June.

Huberia cogniauxii Baumgratz, sp. nov. TYPE: Peru. Depto. Amazonas: Prov. Bongará, Laguna Pomacocha, ridge NE of lake, 77°52′W, 5°50′S, elev. 3350–2450 m, 7 Feb. 1985, *B. Stein & C. Todzia 2116* (holotype, MO; isotypes, CAS, RB). Figures 4, 5.

Arbores, indumento glanduloso-furfuraceo etiam gemmis vegetativis glanduloso-vilosis, ramis tetragonis vel subtetragonis. Folia rigido-membranacea, anguste elliptica, margine basi integro apiceque serrulato, trinervia. Domatia laminaria marsupiformia. Flores 4-meri, hypanthio leviter 8-anguloso, calycis laciniis anguste triangularibus, petalis ellipticis. *Huberia cogniauxii* affinis *H. weberbauerianae* sed praesertim marginalibus nervis secundariis et lateralibus principalibus foliorum basi confluentibus, floribus et fructibus minoribus, petalis apice acuminatis, antherarum thecis planis vel leviter sinuatis et stigma capitatis differt.

Small tree ca. 3 m high. Branches, leaves, inflorescences, bracts, prophylls, pedicels, hypanthium, and calyx glandular-furfuraceous, the vegetative shoots and their adjacent axillary regions also glandular-villous. Branches quadrangular to subquadrangular, striate when young. Petioles 0.6–1.0 cm long. Blades 3.4–5.0 × 1.1–1.8 cm, rigidly membranaceous, narrowly elliptic, the base acute, the apex acuminate, the basal margin ⅓ entire and distal ⅔ serrulate or sparsely serrulate, 3-nerved with the lateral veins arising at the base, the marginal secondary veins tenuous and confluent to lateral primary veins above the base, the central secondary veins 10–14 pairs, oblique-ascendant; abaxial surface with marsupiform laminar domatia, apiculate at the border of the membrane. Inflorescences terminal, sessile, cymoids (Troll, 1969), corymbose or not, 2.5–3.7 cm long, with 19–27 flowers, the branches 4–6, frequently as triads or sometimes sessile monads or triads or umbelliform cymes with 5 flowers, distal node a triad or umbelliform cyme with 7 flowers; bracts membranaceous, foliaceous, 10–20 × 2.2–4.8 mm, petiolate, narrowly elliptic, the apex acuminate, the margin inconspicuous and sparsely serrulate to the apex, or bracts thickened, 1.4–1.5 × 0.3–0.4 mm, sessile, oblong, slightly concave, the apex rounded, the margin entire; prophylls 1–2, 0.4–0.8 × 0.1–0.2 mm, oblong. Flowers 4-merous; pedicel 5.5–6.0 mm long, terete; hypanthium 3.8–4.5 × 1.8–2.1 mm, tubular, slightly 8-angled, the apex slightly constricted; calyx lobes 1.1–1.3 × 0.3–0.5 mm, narrowly triangular, angled at abaxial surface, the base laminar, rigidly membranaceous, the apex subterete, oblong, thickened, rounded; petals white, 9.2–9.8 × 3.1–3.5 mm, elliptic, the apex acuminate; stamens of two sizes, yellow, the antipetalous stamens longer than the antisepalous, the filaments of the longer 5.7–6.0 mm

Figure 4. *Huberia cogniauxii* Baumgratz. —a. Flowering branches. —b. Adaxial surface of the leaf showing the marginal secondary veins confluent to lateral primary veins above the base. —c. Abaxial surface of the leaf showing the pair of domatia and the marginal secondary veins confluent to lateral primary veins above the base. —d, e. Bracts: foliaceous and petiolate, and thickened and sessile, respectively. —f. Prophyll. —g. Flower bud. —h. Flower.

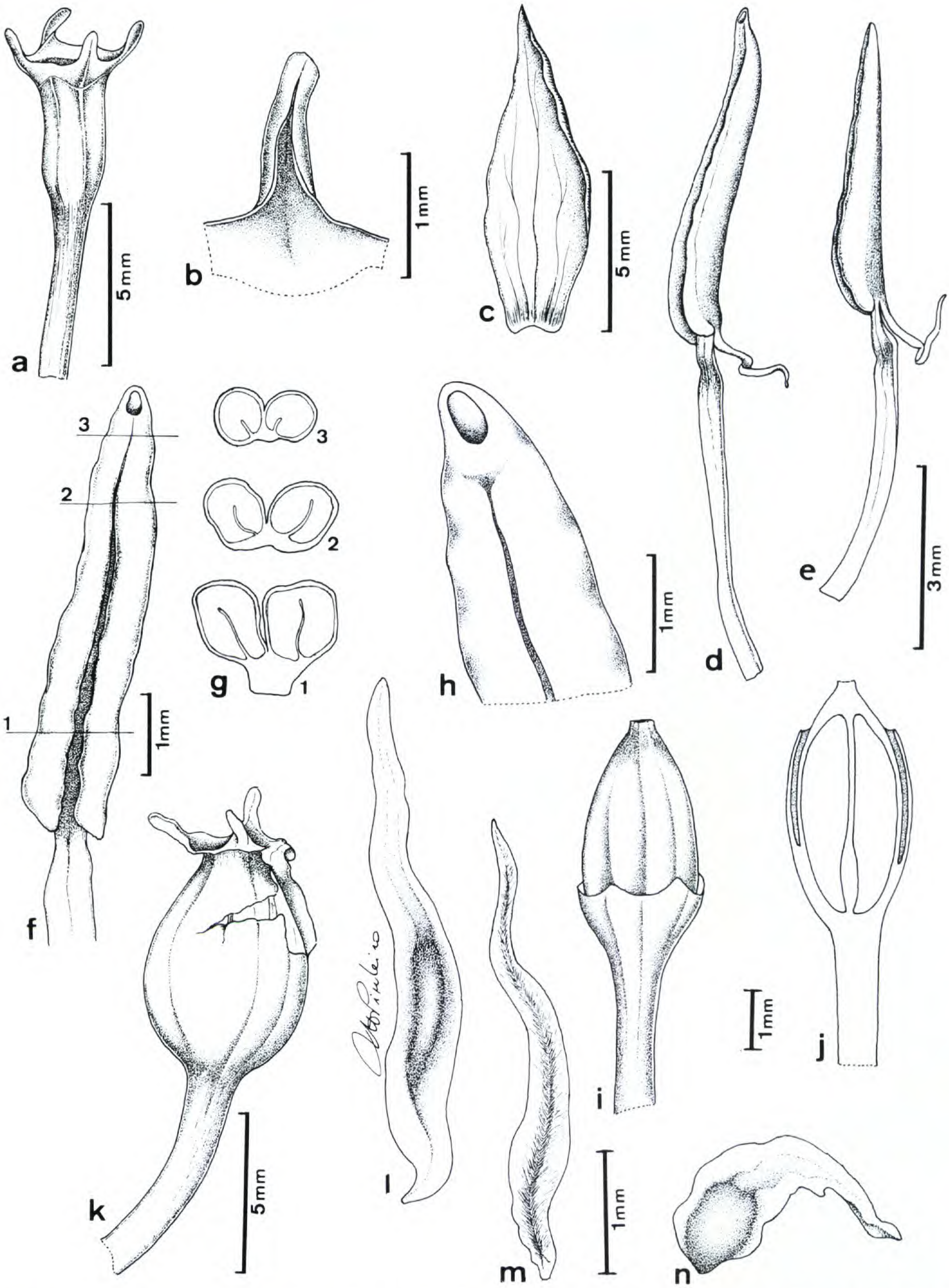

Figure 5. *Huberia cogniauxii* Baumgratz. —a. Pedicel, hypanthium, and calyx. —b. Calyx lobe. —c. Petal. —d, e. Longer and shorter stamens, respectively. —f, g. Anther: adaxial surface and transverse sections at levels in f, illustrating loculi and septa, respectively. —h. Detail of the pore. —i. Ovary. —j. Longitudinal ovary section showing the partial adnation to the hypanthium. —k. Fruit. —l–n. Seeds.

long, of the shorter 5.0–5.2 mm long, the anthers oblong-subulate, the thecae of the longer 5.1–5.5 mm long, of the shorter 4.5–4.7 mm long, smooth to slightly undulate, pseudo-bilocular to unilocular to the apex, the tube unilocular, 0.2–0.3 mm long, the connective appendage 1.3–1.8 mm and 1.5–2.4 mm long, dorsal, filiform, zigzag-shaped; ovary ¾–⅘ free, 3.5–3.8 × 1.7–1.8 mm, 4-locular, the ovules 0.6–0.9 mm long; style 11–13 mm long, the stigma capitate. Fruit a ruptidium (a capsular fruit type; Baumgratz, 1997), 11–13 × 4.5–5.0 mm, the hypanthium and calyx persistent, urceolate, inconspicuously 4-angled, the pedicel 5.5–6.5 mm long; seeds 275–295, (1.4)2.4–4.5 × 0.3–0.6(0.7) mm, winged, linear, rarely narrowly ovate, sometimes sinuous; embryo (0.5)0.6–0.8 mm long.

Distribution. *Huberia cogniauxii* is known only from the type collection. It is endemic to northwestern Peru, occurring at 2450–3350 m in Bongará Province. This region is characterized by cloud forests with rocky places, according to the collectors B. Stein and C. Todzia. The new species is situated in the moist forest of the oriental slopes of Cordillera Central, as described in the study of Young and León (1993).

Huberia cogniauxii is distinguished by leaves with marginal secondary veins confluent to the lateral primary veins above the base, marsupiform laminar domatia, short length of the pedicels, petals, and fruits, short width of the calyx lobes, androecium only with fertile stamens of two sizes, thecae smooth to slightly undulate, stigma capitate, and lesser number of seeds per fruit. Frequently, as observed in the other species of this genus (Baumgratz, 1997), all the indument of the dried specimen is obscured by a viscous substance, inclusively the glandular hairs of the vegetative shoots and their adjacent axillary regions, that are also early caducous. The inflorescences are very condensed and short, with 19, 21, 23, and 27 flowers. Flowering and with fruits in February.

KEY TO THE ANDEAN SPECIES OF *HUBERIA*

1a. Leaves with tubular petiolar domatia; flowers generally 4-merous or sometimes 5-merous; androecium with stamens and staminodia . . . . . *H. staminodia* Baumgratz

1b. Leaves with marsupiform, petiolar, or laminar domatia, flat or like two inflated pockets on the petioles; flowers always 4-merous; androecium with all stamens fertile.

2a. Leaves with petiolar domatia forming two inflated pockets at the apex; calyx lobes 2.1–2.5 mm long; stigma punctiform; fruits 20–26 × 5–7 mm, the pedicel 11–15 mm long . . . . . *H. peruviana* Cogniaux

2b. Leaves with laminar domatia; calyx lobes 1.1–1.9 mm long; stigma capitate; fruits 11.0–17.5 × 2.8–5 mm, the pedicel 2.3–10.0 mm long.

3a. Leaf blades narrowly ovate to elliptic, the marginal secondary veins confluent to lateral primary veins at the base; pedicel 9.0–11.0 mm long; hypanthium 5.5–6.2 mm long; calyx lobes 1.5–1.9 mm long; petals 12.0–14.0 × 4.5–5.8 mm; thecae 5.6–7.3 mm long, conspicuously undulate; style 14.0–16.0 mm long . . . . . *H. weberbaueriana* Baumgratz

3b. Leaf blades narrowly elliptic, the marginal secondary veins confluent to lateral primary veins above the base; pedicel 5.5–6.0 mm long; hypanthium 3.8–4.5 mm long; calyx lobes 1.1–1.3 mm long; petals 9.2–9.8 × 3.1–3.5 mm; thecae 4.5–5.5 mm long, smooth to slightly undulate; style 11.0–13.0 mm long . . . . . *H. cogniauxii* Baumgratz

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Stictocardia sivarajanii, a New Species of Convolvulaceae from Kerala, India

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ABSTRACT. *Stictocardia sivarajanii*, a new species of Convolvulaceae from Kerala, India, is described and illustrated. A tabular comparison with its related species *Stictocardia tiliifolia* is given.

Stictocardia is comprised of about 12 species, of which some are pantropical and others appear to be native to Africa (Verdcourt, 1963). Perhaps the genus originated in Asia or Africa (Austin, 1980). In India, the genus is represented by two species, *Stictocardia tiliifolia* (Desrousseaux) Hallier f. and the new species described here. Plant exploration trips conducted in 1983 and 1996 in Rajamala and Kallar on the high ranges of Western Ghats in the Idukki District of Kerala State, India, yielded a taxon quite different from the species of *Stictocardia* hitherto described (see Table 1). This is presented here as a new species, and is named after the late V. V. Sivarajan in appreciation of his great contribution to Indian taxonomy; S. D. B. and P. M. also gratefully acknowledge his valuable guidance in their research.

Stictocardia sivarajanii Biju, Pushpangadan & P. Mathew, sp. nov. TYPE: India. Kerala: Rajamala shola edge, 28 Sep. 1996, *Biju 40182* (holotype, K; isotypes, CALI, MH, TBGT, US). Figure 1.

Stictocardia sivarajanii sp. nov. affinis *S. tiliifoliae* (Desrousseaux) Hallier f. sed capsula depresse globosa laevi, calycis lobis fructiferis capsulam haud involventibus, pedicellis longioribus, foliis subtus purpureo-violaceis facile distinguenda.

Perennial; stem woody at base, trailing or twining, terete, herbaceous toward tip, pubescent; latex colorless, gummy. Leaves simple, ovate to ovate-deltoid, 4–20 × 3–17 cm, apically acuminate and shortly mucronulate, basally cordate, sparsely pubescent above, young leaf with dorsal side purplish violet, pubescent or tomentose below, covered with minute black glands; midrib and lateral veins raised beneath, lateral veins 8–13 pairs; petiole up to 10 cm long, pubescent, younger ones tomentose. Flowers axillary, solitary or in 2–3-flowered cymes; peduncle up to 15 cm long, terete to angular, pu-

Table 1. Distinction between *Stictocardia tiliifolia* and *S. sivarajanii*.

Stictocardia tiliifolia	*Stictocardia sivarajanii*
Leaf dorsal side pale green, apically acute to short-acuminate and not mucronulate	Leaf dorsal side purplish violet, apically acuminate and mucronulate
Peduncle short, up to 7 cm long	Peduncle long, up to 15 cm long
Sepals suborbicular to orbicular and scarious to shortly ciliate along the margins	Sepals widely ovate to orbicular with nonciliate margins
Capsule globose, 4-lobed, 2.4–3.2 cm long	Capsule depressed globose, entire, 1–1.8 cm long
Fruiting sepals engulfing the capsule, 2.5 × 4.2 cm, smooth	Fruiting sepals not engulfing the capsule, 1.3–1.6 × 1.4–2 cm, striate
Seed obscurely angled, obovoid, prominently hairy at hilum, grayish brown	Seed globose, sparsely pubescent at hilum, black
Usually found along sea shores	Usually found along stream banks in semi-evergreen forest and Ghat roadsides

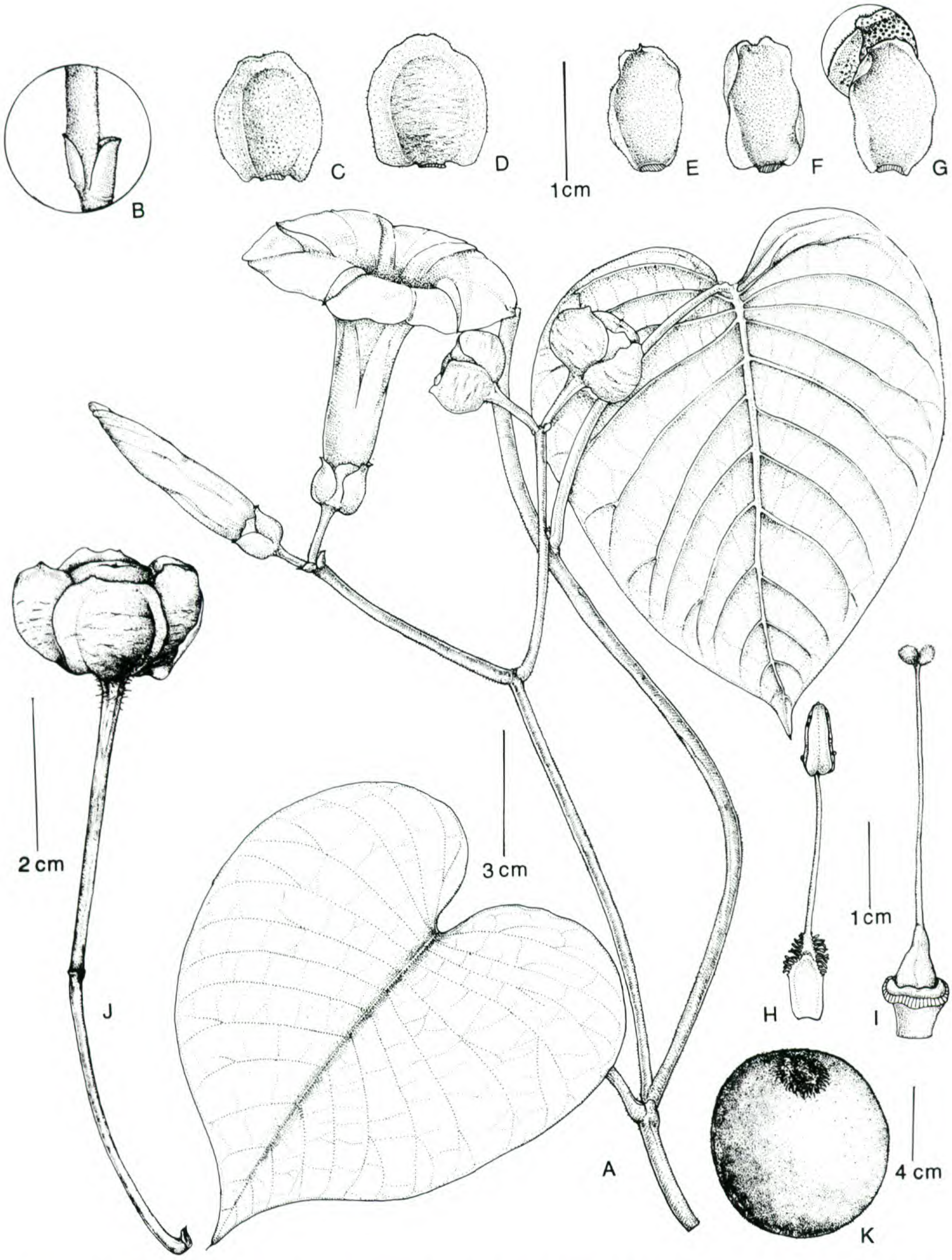

Figure 1. *Stictocardia sivarajanii* Biju, Pushpangadan & P. Mathew. —A. Flowering and fruiting twig. —B. Bracts. —C, D. Outer sepals. —E–G. Inner sepals. —H. Stamen. —I. Pistil. —J. Fruit. —K. Seed. Based on *Biju 22013* (TBGT).

bescent, mostly longer than petiole; bracts 2, ovate-elliptic, small, 5–8 × 2–3 mm, apically acute to slightly acuminate, pubescent outside, glabrous within; pedicels up to 2–4 cm long, pubescent, angled and enlarged in fruits; sepals 5, subequal, outer 2 larger, 1–1.2 × 0.7–0.9 cm, widely ovate to orbicular, apically obtuse to emarginate, densely black glandular on both sides, sparsely pubescent, middle 2 medium-sized, 0.8–1 × 0.5–0.6 cm, broadly ovate-elliptic, apically emarginate and shortly apiculate, glandular dotted, glabrous to puberulent outside, innermost one small, 0.6–0.8 × 0.3–0.4 cm, suborbicular, apically emarginate and shortly apiculate, glandular dotted, glabrous; corolla reddish purple with a darker center, funnel-shaped, tube up to 3.5 cm long, limb slightly 5-lobed, 5–7 cm across, mid petaline bands glabrous and with minute black glands; stamens inserted; anthers up to 7 mm long, straight after dehiscence; filaments attached up to 5 mm above the corolla base, 2 long, up to 2.5 cm, 3 short, up to 2.1 cm long, filiform, purplish red ciliolate at dilated base; disc small, ± 1 mm long, annular, slightly lobed; style subexserted, up to 3.5–3.7 cm long, glabrous, filiform, stigma biglobose, papillose; ovary conical, 1.2 × 2 mm, glabrous, 4-celled. Fruits capsular, indehiscent, depressed globose, not 4-lobed, 1–1.8 × 0.8–1.2 cm, glabrous, not engulfed by the enlarged sepals, which are striate cartilaginous, 1.3–1.6 × 1.4–2 cm; seeds 1–4, globose, 6–8 × 6–7 mm, covered with minute hairs, sparsely pubescent at hilum, pale black; seed germination epigeal, hypocotyl up to 6.5 cm long, glabrous, apically deeply cordate, sinus up to 3.5 cm deep, basally truncate to slightly cordate, petiole up to 1 cm long.

Phenology. Flowering Oct.–Dec. Flower opening 5 a.m.–6:30 a.m., closing after 5 p.m. Fruiting. Dec.–Feb.

Distribution. *Stictocardia sivarajanii* is known from only two localities in Western Ghats, the Eravikulam National Park and Kallar near Munnar, Kerala.

Ecology. The new species is found near stream banks in the semi-evergreen forests and Ghat roadsides generally above 4000 ft.

Etymology. The species is named after the late V. V. Sivarajan.

Paratype. INDIA. **Kerala:** Idukki dist., Kallar, ± 4000 ft., 30 Oct. 1983, *Biju 22013* (TBGT).

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Two New Distinctively Large-leaved Species of *Tovomita* (Clusiaceae) from the Venezuelan and Peruvian Amazonian Region

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ABSTRACT. Two new large-leaved species of *Tovomita* are described: *T. auriculata* from Venezuelan and Peruvian Amazon lowland forests, and *T. foldatsii* from Venezuelan Amazon lowland forests. The morphological relationships to related species are discussed.

RESUMEN. Se describen dos especies nuevas de *Tovomita*: *T. auriculata* de los bosques de tierras bajas de la Amazonía de Perú y Venezuela y *T. foldatsii* de los bosques de tierras bajas de la Amazonía venezolana. Se discuten sus relaciones morfológicas con especies afines.

Tovomita Aublet (Clusiaceae), with about 45 species, is known exclusively from the New World tropics. This genus, one of the most poorly known of the Clusiaceae, is represented in Venezuela by at least 30 species. The two undescribed species were detected during preparation of a treatment of the *Tovomita* for the *Flora of the Venezuelan Guayana.*

Tovomita auriculata Cuello, sp. nov. TYPE: Venezuela. Amazonas: Dpto. Atures, bosque alto de tierra firme en el sector "La Culebra" a 26 km al SE de Pto. Ayacucho, por la carretera Pto. Ayacucho–El Gavilán, 5°31′N, 67°24′W, 80–150 m, ene. 1989 (pist. fl, fr), *N. Cuello & Y. Fernández 480* (holotype, PORT; isotype, MO). Figure 1.

Haec species *T. speciosae* Ducke affinis sed foliis sessilibus, laminis attenuatis, auriculatis, obovatis, petiolis minus quam 5 mm longis, inflorescentia 3–6 mm longa, sepalis externis triangularibus, sepalis internis oblongis, petalis 5, ovario 5-carpellato, atque fructibus rotundatis differt.

Dioecious trees, 3 to 10 m tall. Branches terete, bark corky, ringed by leaf scars. Leaves opposite, decussate, short-petiolate or subsessile, the petioles less than 5 mm long; the blades coriaceous, largely obovate, 9–16 × 30–45 cm, attenuate and auriculate at base, obtuse to rounded at apex, base 1–2 cm wide, lateral veins 12 to 20 pairs, well differentiated and spaced 1–2.2 cm apart, curving toward the margin. Inflorescences cymose, terminal, lenticellate. Pistillate inflorescences 3-flowered, peduncle 1–1.2 cm long, pedicels of lateral flowers 3.4–3.6 cm, pedicel of terminal flower 3.5–4 cm long. Staminate inflorescences 13–39-flowered, 3–6 cm long, pedicels of lateral flowers 5–10 mm long; pedicel of terminal flower 13–16 mm long. Staminate buds 5–9 × 4–6 mm, external sepals 2, rugose and coriaceous, 6–7 × 8–9 mm, internal sepals smooth and membranaceous. Petals 5, oblong, 7–8 × 8–9 mm. Stamens numerous, ca. 60. Pistillate buds oblong-elliptic, 10–15 × 6–8 mm; pistillate flower 15–18 mm long at anthesis; external sepals 2, triangular, 13–15 mm long, 12–16 mm wide at base; internal sepals 2, oblong, 14–16 × 8–10 mm. Petals ovate, 15–18 × 3.5–4.5 mm. Staminodes 40–60, 8–10 mm long. Ovary 5-carpellate, 5 mm long, style 5 mm, stigmas capitate, 2.5–3 mm long. Ovules 1 per carpel, 4–4.3 mm long, axile. Fruits rounded, 3–3.5 cm diam., with persistent stigmas, 5–9 mm long.

Distribution and ecology. Tovomita auriculata is only known from the type and paratype collections, and is apparently a common tree at the lower and medium strata in wet lowland to foothill forests. In Venezuela, it is known by the common name of "palo de tinaja."

Due to its large leaves, *T. auriculata* appears to be most closely related to *T. speciosa* Ducke (Ducke, 1925, 1935) from Brazilian Amazon lowland forests in the states of Amapá and Pará. However, *T. auriculata* has sessile to subsessile leaves, the bases of the obovate blades are attenuate and auriculate (petiole less than 5 mm long), the inflorescences are 3–6 cm long, with triangular and oblong sepals, 5 ovate or oblong petals, ovary with 5 carpels, and rounded fruits, 5–9 mm long. In contrast, *T. speciosa* has the bases of oblong-obovate or elliptic-obovate blades cuneate-attenuate, the petioles are 3–4 cm long, the inflorescences are 2–2.5 cm long, with wide orbicular sepals, 6 obovate-elliptic petals, ovary with 6 carpels, and pyriform fruits, 2.5–3 cm long. In addition, *T. auriculata* is also similar to *T. excelsa* Andrade-Lima & Mariz

Figure 1. *Tovomita auriculata* Cuello (pist. fl and fr, *N. Cuello & Y. Fernández 480*, holotype, PORT).

Figure 2. *Tovomita auriculata* Cuello (stam. fl, *Sanoja & Fernández 3265*, paratype, PORT).

(Mariz, 1974) from wet forests of the state of Alagoas, Brazil. However, *T. auriculata* has coriaceous leaves, petioles less than 5 mm long, and oblong petals, 8–9 mm wide in staminate flowers. *Tovomita excelsa* differs in its membranaceous leaves, 2.5–3-cm-long petioles, and lanceolate petals, 3–5 mm wide in staminate flowers.

Paratypes. PERU. **Loreto**: Prov. Maynas, Quebrada Santa Cruz (tributario del Río Nanay), 03°50′S, 73°35′W, 130 m, Mar. 1982 (fr), *R. Vásquez & J. Ruiz 2945* (MO). VENEZUELA. **Amazonas**: Dpto. Atures, Laguna El Sillón y Caño Mariguaca, 78 km NE Puerto Ayacucho, 05°49′N, 66°50′W, 400 m, Oct. 1989 (buds), Proyecto Inventario de los Recursos Naturales de la Guayana Venezolana-CVG-TECMIN, *Fernández 6409* (MO, PORT); Serranía Batata, 2 km al NE de Salto Colorado, Caño Colorado sobre corazas lateríticas, 55 km al SE de Pto. Ayacucho, 5°33′N, 67°08′W, 550 m, Oct. 1989 (stam. fl), *Sanoja 3240* (PORT unicate), *3265* [MO, PORT (Fig. 2)], *3276* (PORT unicate); Río Cataniapo, 56 km al SE de Pto. Ayacucho, 5°38′N, 67°12′W, 120 m, ago. 1981 (stam. fl), *Guánchez 1425* (TFAV unicate).

Tovomita foldatsii Cuello, sp. nov. TYPE: Venezuela. Amazonas: Dpto. Atures, bosque alto de tierra firme en el sector "Campamento Remo," alto Río Sipapo, 4°34′N, 67°18′W, 80–150 m, junio 1989 (fr), *E. Foldats & J. Velázco 9577* (holotype, PORT; isotype, MO). Figure 3.

Haec species *T. fanshawei* Maguire similis sed petiolis longioribus (6–9 mm vs. 4–5 mm), lamina foliari longiore (30–45 × 20–25 cm vs. 15–22 × 6–9 cm) atque stigmate in fructu lineari (vs. subpeltato) differt.

Dioecious tree, 4–5 m tall. Branches quadrangular, glabrous, with smooth bark. Leaves decussate, the petioles thick, semi-terete, striate, 1.5–2 cm long, 4–5 mm wide; axillary petiolar flaps conspicuously raised, 6–9 mm diam., the blades coriaceous, broadly oblong-elliptical, 30–45 × 20–25 cm, shortly attenuate at base, obtuse to rounded at apex, lateral nerves prominent, 17–21 pairs, 2–3.2 cm apart. Inflorescences and flowers unknown. Fruit a fleshy stipitate capsule, ellipsoidal to fusiform, 8–10 × 2.5–3 cm; with a style 1.2–2 cm long and 5 linear stigmas; stipe 1–2 cm long; staminodes usually persistent in fruit. Seeds reniform, 3.5–4 × 0.9–1.2 cm, 1 per locule, apparently with a fleshy aril-like covering.

Distribution and ecology. *Tovomita foldatsii* is found in lowland wet forests of the eastern Amazonas in Venezuela and is known only from the type collection.

Tovomita foldatsii is a distinctive species belonging to the large-leaved complex (*T. macrophylla* (Poeppig) Walpers, *T. fanshawei* Maguire, *T. morii*

Figure 3. *Tovomita foldatsii* Cuello (fr, *E. Foldats & J. Velázco 9577*, holotype, PORT).

Maguire, *T. speciosa* Ducke, *T. froessi* Maguire, and *T. auriculata* Cuello) from Panama, the Amazon Basin, and Guiana Shield. Among those, *T. foldatsii* is most closely related to *T. fanshawei* Maguire (Maguire, 1948) from Guyana, Colombia, Peru, Brazil, and Bolivia (Cuello, 1998), both having raised axillary petiolar flaps. However, in *T. foldatsii*, the blades (30–45 × 20–25 cm) and axillary petiolar flaps (6–9 mm) are much larger than in *T. fanshawei* (15–22 × 6–9 cm and 4–5 mm, respectively), and the stigmas in the fruits of *T. foldatsii* are linear and not subpeltate as are those in *T. fanshawei*. In addition, *T. foldatsii* is similar to *T. morii* Maguire (Maguire, 1978), from Panama, having quadrangular branches in common. However, *T. foldatsii* is a tree, with petioles 1.5–2 cm long, a broadly oblong-elliptical lamina, 30–45 × 20–25 cm, and stipitate fruit, 8–10 × 2.5–3 cm. In contrast, *T. morii* is an epiphytic shrub, with petioles less than 0.5 cm long, broadly oblanceolate lamina, 18–25 × 10–14 cm, and non-stipitate fruit, 4–5 × ca. 2 cm.

This species is named in honor of Ernesto Foldats due to his significant contributions to our knowledge of the Venezuelan flora, and for collecting the type specimen.

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The Identity of *Grimmia involucrata* Cardot (Grimmiaceae, Musci)

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ABSTRACT. *Grimmia involucrata* is a Mexican endemic that has been confused with *G. affinis*, *G. americana*, and *G. tergestina*. It is recognized here as a valid, morphologically distinct species characterized by clavate stems, a gonioautoicous condition, differentiated perichaetial leaves, immersed sporophytes, and the smooth basal third of the outer plate of the peristome teeth. It is illustrated herein.

Grimmia involucrata was described by Cardot (1909) on the basis of a specimen collected in the state of Hidalgo, Mexico. Reference to this species was made by Thériot (1931), who listed specimens collected by Amable in Mexico City; Sayre (1952) and Whitehouse and McAllister (1954) treated it as conspecific with *G. americana* Bartram, a species described from Texas (Bartram, 1929). Crum and Anderson (1981: 424) disagreed and concluded that *G. involucrata* was not "even a member of the subgenus *Gasterogrimmia* Schimp." In recent years, Crum (1994) treated it as a synonym of *G. affinis* Hornschuch; he also studied a mixed specimen from the type locality of *G. involucrata* that he referred to *G. tergestina* Tommasini, an Old World taxon.

Except for occasional reference in floristic lists or indices, information on *G. involucrata* is scarcely available. Descriptions other than the original have been lacking, as have illustrations. In addition, the type specimen is a mixed collection, which has contributed to confusion regarding the taxonomic identity and nomenclature of *G. involucrata* and other Mexican Grimmias. This paper attempts to clarify its status.

Grimmia involucrata Cardot, Rev. Bryol. 36: 105. 1909. TYPE: Mexico. Hidalgo: Cuyamaloya, on rocks, 17 Sep. 1908, *Pringle 10598 p.p.* (holotype, PC not seen; isotypes, FH, H-BR). Figure 1.

Stem clavate, dark green or black, up to 9 mm high, with a central strand; in cross section with an epidermal layer of 1–2 layers of smaller thick-walled cells. Leaves concave in proximal and mid-leaf sections, carinate at extreme apex, imbricate when dry, erect-spreading when moist, oblong-ovate, 0.9–1.3 mm in length; apex obtuse; distal leaf margins bistratose, plane, entire. Distal leaf cells quadrate to short rectangular, in 2(–3) layers of thick-walled, slightly sinuose cells, 5–12 μm diam.; marginal leaf cells at base quadrate to short rectangular or transversely elongated, with thicker cross walls, 7–17 μm diam.; other basal cells unistratose, quadrate to rectangular, thick-walled, slightly sinuose upward; basal juxtacostal cells not forming a distinct area, mostly quadrate and thin-walled. Costa excurrent, in section with one dorsal substereid layer and 2–6 guide cells around or ventral to an internal hydroid group. Hair-point 0.6–1.3 mm long, denticulate, slightly decurrent at base. Gonioautoicous. Perigonial bracts convolute, 0.6 mm long. Perichaetial leaves strongly differentiated, the outer with a hyaline marginal area, the inner mostly thin-walled and hyaline; oblong-ovate to convolute, 1.4–1.9 mm long; hair-point 0.9–1.6 mm long. Seta straight, 0.5 mm long, not twisted. Capsule symmetrical, ellipsoid, immersed, 1.2–1.4 mm long; peristome teeth somewhat cribrose, deltoid, 287–300 × 62–75 μm, straw-colored to orange, outer plate nearly smooth in the lower third, trabeculate, distally papillose; inner plate finely papillose throughout; annulus revoluble; exothecial cells prismatic, mostly longer than wide, thin-walled, 25–60 μm diam.; stomata several, basal; operculum conic, short-rostrate, 0.7 mm long; calyptra mitrate, smooth, 0.9–1 mm long. Spores 10–15 μm diam., spore wall perforated.

Distribution. Endemic to Mexico (Distrito Federal, Hidalgo, México, Zacatecas).

Habitat. On rocks or soil-covered rocks, in *Pinus* forest, dwarf oak forest, or desert scrub, 2180–2590 m elevation.

The costa in *Grimmia involucrata* is reported here as excurrent because there is morphological continuity of the inner costal cells with those of the hair-point. The latter consists, in addition, of hyaline laminal cells in this and other species of the genus, but its ontogeny is still unknown.

As noted by Cardot (1909), *G. involucrata* is similar to *G. tergestina*. Both taxa have clavate

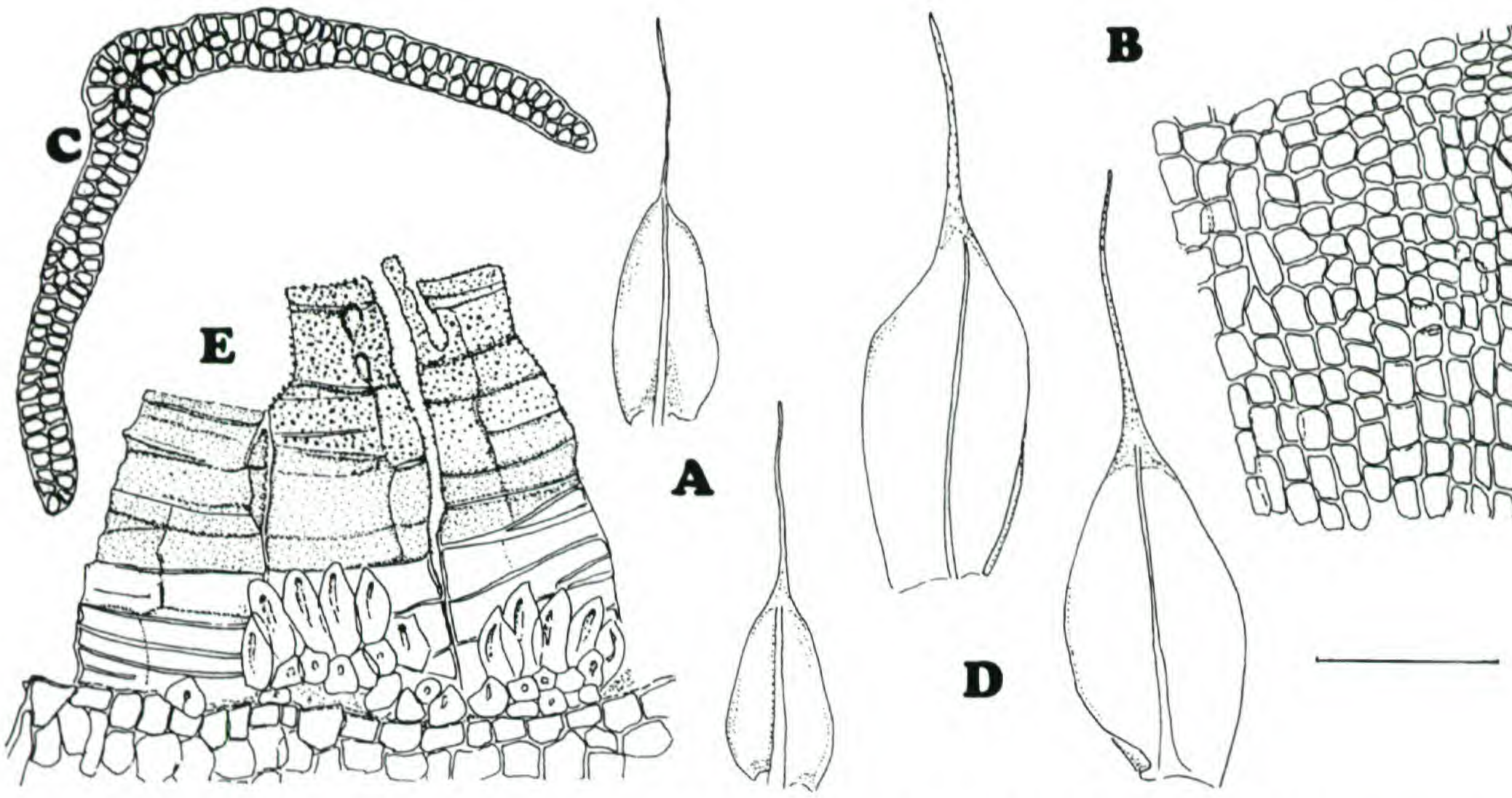

Figure 1. *Grimmia involucrata* Cardot. —A. Vegetative leaves. —B. Leaf basal cells. —C. Leaf cross section in distal half. —D. Perichaetial leaves. —E. Portion of peristome showing smooth outer plate and papillose distal end of broken teeth. Drawings from the type specimen, except A (*Cárdenas 3018*) and E (*Cárdenas 3912*). Scale = 1 mm (A, D), = 0.1 mm (B, C, E).

stems due to large differentiated perichaetial leaves that enclose an immersed sporophyte; their vegetative leaves are bistratose in the distal half bearing a decurrent denticulate hyaline hair; the basal leaf cells are quadrate to short rectangular and, in section, the costa has several guide cells frequently surrounding a single hydroid group. Although similar in general morphology, the gametophore in *G. involucrata* is consistently gonioautoicous and the peristome teeth are papillose except at the outer base and have conspicuous trabeculae. In *G. tergestina* the gametophore is dioicous and its peristome teeth virtually lack basal trabeculae and are papillose throughout. The taxonomic significance of these differences remains problematic; the peristome structure in *G. tergestina* is comparable to that of *G. involucrata* so that their only reliable morphological difference is the sexual condition.

According to Churchill and Linares (1995), *Grimmia affinis* is not present in the Neotropics and may be a synonym of *G. longirostris* Hooker. In any event, neither *G. affinis* nor *G. longirostris* is closely related to *G. involucrata*. Their leaf cross sections show an elliptical to reniform costa with a ventral u-shaped sinus distally; at mid-leaf, there is a row of 2–4 ventral guide cells overlying a central hydroid group and a dorsal epidermal layer of substereid cells; the capsule is exserted in *G. affinis*. Thus, the proposed synonymy between this and *G. involucrata* (Crum, 1994) does not have a taxonomic basis, for they are clearly distinct. The confusion apparently derives from plants of a second *Grimmia* in the type specimen of *G. involucrata*. Cardot (1909) stated that this contained *G. ovata* F. Weber & D. Mohr, a taxon currently considered a synonym of *G. affinis*. A similar mixture was observed in *Pringle 10599* (MEXU), also from the type locality.

At present, *Grimmia involucrata* is considered a valid species endemic to Mexico. Its presumed distribution in Texas is based on collections of *Grimmia americana*, a species that is distinguished by its ventricose sporophytes.

Specimens examined. MEXICO. **Distrito Federal:** Zacatenco, *Amable 1352* (MEXU); Tlalpan, *Amable 1448* (MEXU). **Hidalgo:** Cuyamaloya, Sierra de Pachuca, *Pringle 10599 p.p.* (MEXU); alrededores de Ciudad Sahagún, *Cárdenas 3108* (MEXU). **México:** Sierra de Alcaparrosa, 4 km NW de Tepotzotlán, 19°44′N, 99°15′W, *Cárdenas 3912* (MEXU). **Zacatecas:** 1 km S de Troncoso, *Cárdenas 3092* (MEXU); Cerro Gordo, 3 km SE de La Colonia Hidalgo, 22°30′N, 102°13′W, *Cárdenas 736* (MEXU); 2 km S de San Juan de los Hornillos, cerca de Presa Hornos, 23°01′N, 103°11′W, *Cárdenas 752* (MEXU).

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Caxamarca, a New Monotypic Genus of Senecioneae (Asteraceae) from Northern Peru

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ABSTRACT. A new monotypic genus of Asteraceae–Senecioneae, *Caxamarca*, is described from northern Peru. The single herbaceous perennial species, *Caxamarca sanchezii* M. O. Dillon & Sagástegui, is endemic to the seasonally dry valleys of southwestern Cajamarca. The potential relationships of the genus are discussed.

RESUMEN. Un género monotípico nuevo de Asteraceae–Senecioneae, *Caxamarca* se describe para el norte de Perú. La única especie, la herbácea perenne, *Caxamarca sanchezii* M. O. Dillon et Sagástegui, es endémica de los valles estacionalmente secos del suroeste del Departamento de Cajamarca. Se discuten las relaciones potenciales del género.

During continuing detailed studies on the flora of northern Peru, the following monotypic genus of Senecioneae (Asteraceae) was encountered in the seasonally dry river valleys in southwestern Cajamarca. This new genus is proposed after an exhaustive examination of all available genera within the tribe and detailed studies on many neotropical members of the large and complex genus *Senecio* L. While generic concepts within the Senecioneae have been reviewed (Barkley, 1985a; Barkley et al., 1996; Bremer, 1994; Nordenstam, 1978), future changes are to be expected as taxonomies are tested with data from other disciplines, such as molecular systematics.

Caxamarca (Asteraceae tribe Senecioneae) M. O. Dillon & Sagástegui, gen. nov. TYPE: *Caxamarca sanchezii* M. O. Dillon & Sagástegui.

Herba rhizomatosa usque ad 1.5 m alta, radices carnosi foetidi; caules erecti simplexalata medullosus. Folia basale 40–50 cm longa, profunde pinnatisecta. Folia caulina alterna, herbacea, sessilia, basi decurrentis; lamina plana herbacea 20–35 cm longa, 7–11 cm lata, margine distincte denticulata. Capitulescentiae corymboso-cymosae 3–20 capitulis (vulgo 3–7). Capitula heterogama radiata ca. 10 mm alta, ca 10 mm lata; phyllaria subbiseriatis 17–28 (vulgo 22–28). Flores radiati pistillati 10–22; ligulae luteae, 10–25 mm longae, 4–8 mm latae. Flores disci hermaphroditi 80–160 (vulgo 80–130); corollae tubulosae luteae, 12–15 mm longae; limbus profunde quinquelobus. Antherae basis sagittata; collum filamenti basi dilatatum. Styli rami apice conico pilis penicillum centrale. Achaenia decemcostata pilosus; pappi setae biseriate 6–7 mm longus barbellatae persistentes.

Caxamarca sanchezii M. O. Dillon & Sagástegui, sp. nov. TYPE: Peru. Dept. Cajamarca: Prov. Contumazá, Alrededor de San Benito, 1200 m, 12 May 1994, *A. Sagástegui A., S. Leiva & C. Sagástegui 15185* (holotype, HAO; isotypes, CPUN, F, MO, US). Figures 1, 2.

Perennial herbs to 1.5 m tall; roots fasciculate, tuberous, malodorous, individual tubers 8–12 cm long, 2–3 cm diam., white; stems fistulose, 1–2.5 cm diam. at the base, unbranched, glabrous, winged by the decurrent leaf bases, the wings 4–7 mm wide, glabrous, reticulate-nerved, denticulate, ciliolate. Leaves basal and cauline; basal leaves rosulate, the blades profoundly dissected, odd pinnate, the rachis 40–50 cm long, 8–10 pairs of leaflets, the leaflets ovate to lanceolate, 5–10 cm long, 2–6 cm wide, the margins dentate-serrate; cauline leaves alternate, sessile, decurrent, the blades oblong-lanceolate, 20–35 cm long, 7–11 cm wide, membranous, apically acuminate, the margins irregularly dentate-serrate, reticulate-nerved, glabrous, the nerves sparsely pilose. Capitulescences cymose-corymbose. Capitula 3–7(–20), radiate; pedicels 1–8 cm long, striate, swollen apically, densely pilose; calyculus (10–)16–22-bracteolate, the bracts narrowly linear, 1–2 cm long, 0.5–1 mm wide, acuminate apically, 1-nerved, greenish purple; involucres hemispherical, ca. 10 mm tall, ca. 10 mm wide; phyllaries (17–)22–28, weakly biseriate, equal, lanceolate, 8–10 mm long, 2–3 mm wide, fused at the base, glabrous or pilose, acuminate; ray florets 10–22, pistillate, the corolla yellow, the tube 0.5–0.6 mm long, glabrous, the ligule oblong-linear, 10–25 mm long, 4–8 mm wide, glabrous, 10–12-nerved, 2–3-dentate apically; disc

Figure 1. *Caxamarca sanchezii* M. O. Dillon & Sagástegui. —A. Flowering branch. —B. Portion of basal leaf. —C. Fleshy roots. —D. Capitulum. —E. Involucre. —F. Ray floret. —G. Disc floret. —H. Corolla lobes. —I. Stamen. —J. Style branches of disc floret. —K. Achene with pappus. —L. Enlargement of achene cross section. Illustration based on *Sagástegui, Leiva & Sagástegui 15185* (HAO).

Figure 2. *Caxamarca sanchezii.* —A. Basal leaves in greenhouse grown plant (scale in inches). —B. Flowering stem photographed in the field. —C. Capitulescence.

florets 80–130(–160), hermaphroditic, the corollas yellow, tubular, 12–15 mm long, the throat slightly expanded, deeply 5-lobed, the lobes oblong, 2–2.5 mm long, 0.8–1 mm wide, apically obtuse, reflexed; anther bases sagittate, the filaments basal collar swollen or balusterform; style branches with parallel stigmatic lines, the apices conical with a terminal crown of penicillate trichomes. Achenes cy-

lindrical, 2.5–4 mm long, 0.5–0.6 mm wide, 10-costate, densely pilose with biseriate trichomes; pappus biseriate, persistent, the bristles subequal, barbellate, 6–7 mm long.

Distribution and ecology. *Caxamarca sanchezii* grows in clay soils in semi-arid open habitats with scattered deciduous small trees and evergreen shrubs. It is confined to the adjacent cuencas or drainage basins of the Río Chicama and Río Jequetepeque (1200–2200 m) in southwestern Department of Cajamarca. These areas are a part of the western or Pacific slope with the rivers draining to the Pacific Ocean. The prevailing weather pattern, and hence available moisture, is associated with coastal weather systems and unpredictable but recurrent El Niño conditions (Dillon & Rundel, 1990). Flowering is between March and May in normal years.

In favorable years, the associated floristic community is dominated by several annual Poaceae genera. Other species recorded from the collecting localities include *Acacia angustissima* (Miller) Kuntze (Fabaceae), *Caesalpinia paipai* Ruiz & Pavón, *C. spinosa* (Molina) Kuntze (Fabaceae), *Eriotheca discolor* (HBK) Robyns (Bombacaceae), *Cordia macrocephala* (Desvaux) Kunth, *C. munda* I. M. Johnston (Boraginaceae), *Solanum* sp. (Solanaceae), *Verbesina saubinetioides* S. F. Blake (Asteraceae), *Zinnia peruviana* (L.) L. (Asteraceae). The region also contains an association of several geophytes: *Ismene amancaes* (Ruiz & Pavón) Herbert (Amaryllidaceae), *Leptochiton helianthus* (Ravenna) Gereau & Meerow (Amaryllidaceae), *Stenomesson* sp. (Amaryllidaceae), and *Trichlora peruviana* Baker (Liliaceae).

Phenology. The life history of *Caxamarca* in the seasonally dry valleys of southwestern Cajamarca is closely connected with the yearly cycles of rain and drought. In the region where it is endemic, the rainy season typically begins in late December and rainfall increases steadily until March. By April the rains begin to decrease and by the end of May the area is completely dry once again. Rainfall between June and November is infrequent and of short duration. Soon after the rainy season begins, a series of long-petioled, basal leaves emerge sequentially, one every 4–5 days. Basal leaves are unknown from field-collected material since they are extremely ephemeral, but were observed in cultivated plants (Fig. 2A). In nature, the basal leaves are completely absent in flowering individuals; they develop and die back to the ground prior to the development of the flowering stems. The flowering shoot develops rapidly, and vegetative growth, flowering, and fruiting are completed within three months. After flowering, the stems die back and leave little trace of their existence until the next year. Some aspects of its autecology are similar to geophytes which begin their development with the coming of the rainy season and flower after the vegetative growth period.

Etymology. The generic name is derived from the original Spanish rendering of Cajamarca, the native Quechua name for this area in northern Peru. It is a pleasure to dedicate this new species to its first collector, Isidoro Sánchez Vega, the founder and current director of the herbarium at Universidad Nacional de Cajamarca (CPUN).

Paratypes. PERU. **Dept. Cajamarca:** Prov. Contumazá, Travesía de Andaloy (San Benito–Yetón), *Sagástegui & Leiva 15491* (F, HAO), *Sagástegui & Leiva 15536* (F, HAO); S. O. de El Rupe, Km 13 de la carretera Chilete–Contumazá, *Sánchez 2243* (CPUN); Chilete–Rupe, *Sánchez 4219* (CPUN, HAO); Cushtón (Chilete–Contumazá), *Sagástegui et al. 15628* (F, HAO), *Sagástegui et al. 15857* (F, HAO); Tambo La Lima (Cascas–Contumazá), *Sagástegui et al. 15548* (F, HAO); Prov. San Pablo, San Bernardino–Sangal, *Sagástegui et al. 15597* (F, HAO).

Discussion. Our studies in the Andean Senecioneae (Dillon & Sagástegui, 1988, 1996; Vision & Dillon, 1996; Sagástegui & Dillon, 1985) have revealed rich generic and species diversity. With this addition, Peru contains no fewer than 15 described genera and over 320 species within the tribe Senecioneae (Dillon & Hensold, 1993). This new genus belongs to the subtribe Senecioninae Dumortier, diagnosed by a series of microcharacters, including balusterform anther collars and style branches with separate stigmatic lines (Bremer, 1994).

The combination of characters displayed by *Caxamarca* does not allow its placement within any described genus known to us within the Senecioneae: the distinctive herbaceous perennial habit, with enlarged fleshy or tuberous roots, precocious basal leaves (Fig. 2A), scapose fistulose stems with decurrent cauline leaves (Fig. 2B), lax and few-headed cymes, and large capitula with conspicuous reflexed, bright yellow ray corollas (Fig. 2C). The style branches of the disc florets have parallel stigmatic lines and convex to triangular apices with a terminal crown of penicillate trichomes. This type of style apex is unlike those found in the large and diverse genus *Senecio* L.

Principal basal leaves and fibrous roots similar to those present in *Caxamarca* are known from other genera within the Senecioneae, for example, *Pippenalia*, a Mexican radiate genus once considered intermediate between *Cacalia* and *Senecio* (Barkley,

1985b; Barkley et al., 1996). Some species of *Senecio* develop prominent basal leaves, for example, the Brazilian *Senecio pulcher* Hooker & Arnott. The morphology of the basal leaves in *Caxamarca* is still an open question since basal leaves have not been collected in the field. While not common, fleshy roots with greatly thickened tubers do occur in some Mexican *Rolandas* (T. Barkley, pers. comm.) and in other tribes such as the Liabeae (e.g., *Munnozia sagasteguii* H. Robinson) occurring in this region.

In the key to genera provided by Vision and Dillon (1996), *Caxamarca* would key to *Dorobaea* Cassini. The large radiate hemispheric capitula with well-developed calyculus and numerous phyllaries are reminiscent of those found in *Dorobaea*, a small Andean genus distributed in northern Peru, Ecuador, and southern Colombia (Nordenstam, 1978; Nordenstam & Pruski, 1995). *Dorobaea* was established as distinct from *Senecio* on character differences in the habit, capitulescences, and floral morphology. The distinctness of the genus has been confirmed by cpDNA variation studies (Kadereit & Jeffrey, 1996). *Dorobaea* has deeply lobed or pinnate, basally rosulate leaves present at the time of flowering. It has a leafless, scapose capitulescence bearing a solitary, radiate capitulum. *Dorobaea* has slightly thickened fibrous roots, not unlike those in *Caxamarca*, but in *Dorobaea* the roots are typically no more than 7–10 cm long and ca. 1 cm in diameter. Within its range, *Dorobaea* is distributed in mesic habitats at elevations above 2000 m, and while *Dorobaea* and *Caxamarca* are both distributed in Cajamarca, they are ecologically and geographically isolated. The chromosome number for *Dorobaea* has been reported as n = ca. 50 (Dillon & Turner, 1982). A chromosome count for *Caxamarca* should be useful in efforts to determine the relationships of this genus (Robinson et al., 1997).

The following key is provided for Andean genera with herbaceous or suffrutescent habits, radiate capitula with a prominent calyculus, and conical to triangular style branch apices.

KEY TO *CAXAMARCA* AND POTENTIALLY RELATED ANDEAN GENERA

1a. Scandent, herbaceous perennials or suffrutescent vines; leaves strictly cauline; petioles not long-decurrent on stems; capitula radiate (rarely discoid).
  2a. Reclining, herbaceous perennials (typically hydrophilic); capitula radiate, the corollas yellow or orange; anther collar filament cylindrical, the theca bases rounded . . . . . *Garcibarrigoa* Cuatrecasas
  2b. Robust, suffrutescent vines; capitula radiate or discoid, the corollas orange or occasionally rose to purple; anther collar filament swollen or balusterform . . . . . *Pseudogynoxys* (Greenman) Cabrera
1b. Erect, herbaceous perennials; leaves basal, or basal and cauline with long-decurrent petioles; capitula radiate.
  3a. Leaves strictly basal, no cauline leaves evident; capitulescence a long-scapose, solitary capitulum . . . . . *Dorobaea* Cassini
  3b. Leaves basal and cauline; capitulescence cymose-corymbose . . . . . *Caxamarca* M. O. Dillon & Sagástegui

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New Taxa of Ericaceae from China

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ABSTRACT. Nine new species (*Cassiope membranifolia*, *Gaultheria heteromera*, *G. jingdongensis*, *G. longibracteolata*, *G. pseudonotabilis*, *G. purpurea*, *G. trigonoclada*, *Vaccinium rubescens*, *V. tenuiflorum*), four new varieties (*Enkianthus deflexus* var. *glabrescens*, *Gaultheria dumicola* var. *hirticaulis*, *G. griffithiana* var. *insignis*, *G. wardii* var. *elongata*), a new name (*G. straminea*), and four new combinations (*Enkianthus serrulatus* var. *sichuanensis*, *Gaultheria leucocarpa* var. *yunnanensis*, *G. leucocarpa* var. *psilocarpa*, *G. brevistipes*) are proposed.

As a result of a recent visit to several herbaria in the United States, as well as the examination of additional material that has accumulated in Chinese herbaria since the publication of Fang's (1991) treatment of the Ericaceae for *Flora Reipublicae Popularis Sinicae*, the following novelties are proposed to make the names available for the forthcoming account of the Ericaceae for the *Flora of China*.

Cassiope membranifolia R. C. Fang, sp. nov. TYPE: China. W Yunnan: Lushui Xian, 3600 m, 25 Aug. 1964, *S. G. Wu 8423* (holotype, KUN). Figure 1.

Species nova *C. myosuroidae* W. W. Smith affinis, a quo foliis plerumque suborbicularibus raro ellipticis, dorsis saepe glabris, acuminibus membranaceis laminis aequalibus vel longioribus, 1–2 mm longis differt.

Procumbent slender shrubs. Stems elongated, ca. 26 cm long. Leaves assurgent, densely imbricate on stem, appressed in 4 ranks; leaf blade suborbicular, rarely elliptic, scale-like, 1.2–1.8 × 1–1.5 mm, coriaceous, adaxially concave, glabrous, abaxially not furrowed, convex, glabrous or sometimes pilose at base, base arched, margin distinctly membranous, membranous rim upward forming an elongated-triangular hyaline acumen as long as or longer than blade. Flowers solitary, axillary. Pedicels 1–2.5 cm long, densely crisped-tomentose, base with 3 lacerate bracts; bracteole absent. Calyx purple, glabrous; lobes subfree, oblong, ca. 2.5 mm long, margins membranous, fimbriate. Corolla white, campanulate, 5–7 mm long, glabrous outside, 5-lobed; lobes ovate, ca. 2 mm long. Stamens 10, ca. 1.5 mm long; filaments linear, flattened, pilose or glabrous; anthers ovate, with 2 recurved awns ca. 1 mm long. Ovary glabrous. Capsule not seen. Flowering August.

Distribution and ecology. China, western Yunnan Province. Alpine meadows among moss on rocks; ca. 3600 m.

Cassiope membranifolia appears to be closely related to *C. myosuroides* W. W. Smith, which has a similar membranous leaf blade margin. It differs in that the leaf margin is membranous with the distal portion of the rim forming a hyaline elongated-triangular acumen, and in the leaf blades being suborbicular, rarely elliptic, adaxially concave, roughened, and abaxially subglabrous.

Paratypes. CHINA. **Yunnan:** without locality, *G. Forrest 7982* (A); Lushui Xian, *Bijiang Exped. 1772* (KUN).

Enkianthus deflexus (Griffith) C. K. Schneider var. **glabrescens** R. C. Fang, var. nov. TYPE: China. Gansu: Wen Xian, 1640 m, 21 July 1991, *Y. F. Wang & X. L. Chen 911007* (holotype, MO).

A var. *deflexo* foliis utrinque glabrescentibus vel abaxialiter ad costas sparse hispidulis; petiolis glabris; rhachidibus et pedicellis pubescentibus et pilis glanduliferis obtectis differt.

Enkianthus deflexus var. *glabrescens* differs from variety *deflexus* in having leaf blades glabrescent on both surfaces or abaxially sparsely hispidulous along the midrib, glabrous petioles, and glandular-pubescent rachises and pedicels. Except for this new variety, all of the other Chinese taxa of *Enkianthus* are found in provinces south of the Changjing (Yangtze River).

Enkianthus serrulatus (Wilson) C. K. Schneider var. **sichuanensis** (T. Z. Hsu) R. C. Fang, stat. et comb. nov. Basionym: *Enkianthus sichuanensis* T. Z. Hsu, Acta Bot. Yunnan. 4: 358. 1982. TYPE: China. Sichuan: Fengjie Xian, *M. Y. Fang 24515* (holotype, HIB not seen; isotype, KUN).

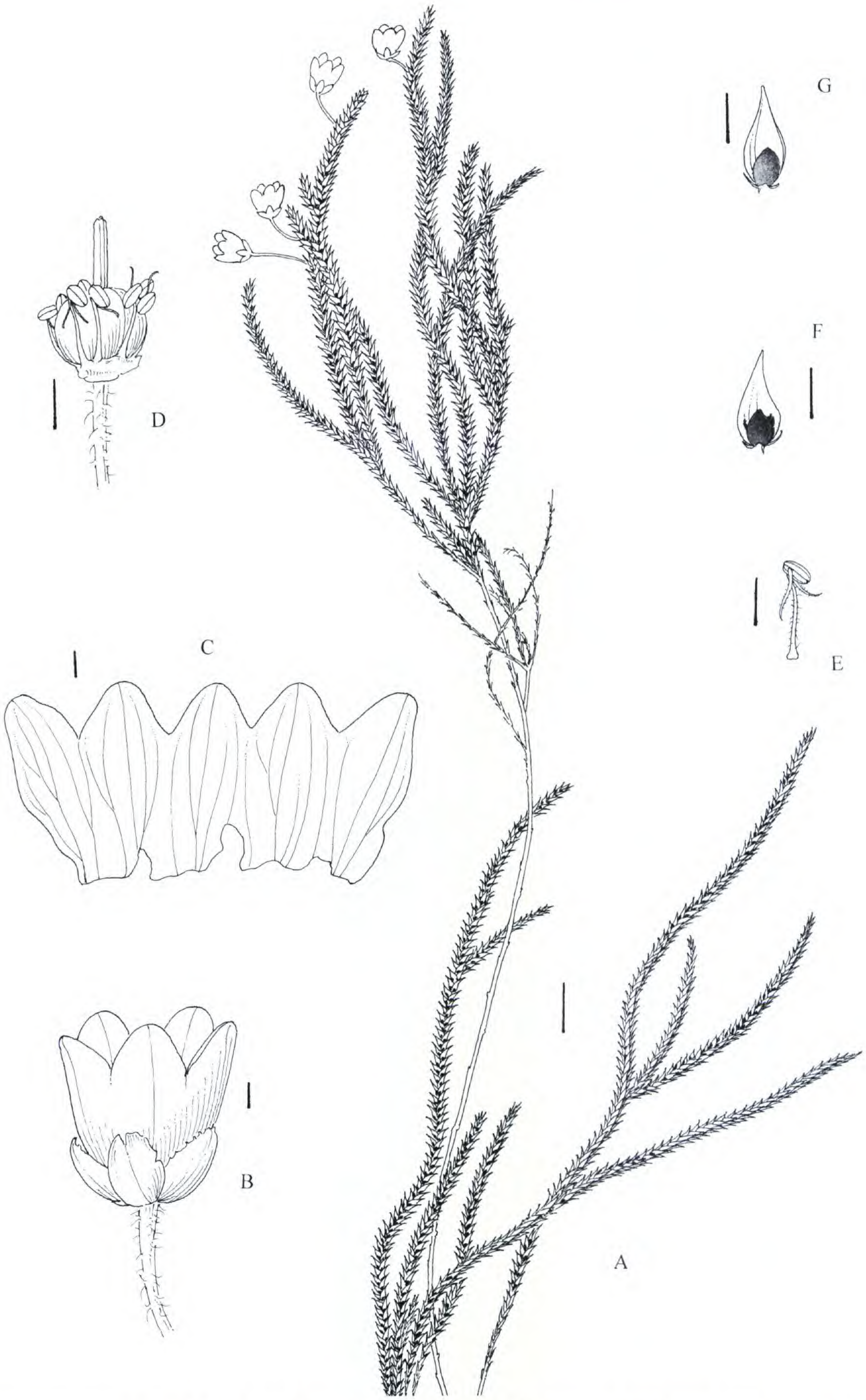


Figure 1. *Cassiope membranifolia* R. C. Fang. —A. Habit. —B. Flower. —C. Opened corolla. —D. Stamens and pistil. —E. Stamen. —F. Adaxial leaf surface. —G. Abaxial leaf surface. Scale bars: A = 1 cm, B–G = 1 mm. Drawn from holotype (*S. G. Wu 8423*).

Enkianthus sichuanensis was based on a single collection, which is indistinguishable from material of *E. serrulatus*, except for the hairy ovary. *Enkianthus sichuanensis* is reduced to a variety of *E. serrulatus* since the type collection of the former was collected from within the range of the latter.

Gaultheria brevistipes (C. Y. Wu & T. Z. Hsu) R. C. Fang, comb. nov. Basionym: *Leucothoe brevistipes* C. Y. Wu & T. Z. Hsu, Act. Phytotax. Sin. 23: 315. 1985. *Leucothoe griffithiana* C. B. Clarke var. *sessilifolia* C. Y. Wu & T. Z. Hsu, Fl. Xizang. 3: 684. 1986. TYPE: China. Xizang: Medog, *Qinghai-Xizang Complex Exped. 74-3951* (holotype, KUN).

Both *Leucothoe brevistipes* and *L. griffithiana* var. *sessilifolia* are based on the same collection number. Hsu (1991) incorrectly listed the species as *L. sessilifolia* C. Y. Wu & T. Z. Hsu [sic] with the exact bibliographical citation of *L. brevistipes*, and cited *L. griffithiana* var. *sessilifolia* as a synonym.

Additional specimens examined. CHINA. **Xizang:** Medog, *B. S. Li & S. Z. Cheng 1289, 2496, 3358, 3741, 4757, 5082* (KUN), *H. Sun, Z. K. Zhou & H. Y. Yu* 516, *2751, 3655, 3713, 4827* (KUN).

Gaultheria dumicola W. W. Smith var. **hirticaulis** R. C. Fang, var. nov. TYPE: China. SE Yunnan: Malipo Xian, 2000 m, 6 Dec. 1962, *Q. A. Wu 62–134* (holotype, KUN).

A var. *dumicola* recedit caulibus densissime brunneo-hirsutis, foliis subtus hispidis.

Juvenile and adult branches densely brown-hirsute. Leaf blade ovate, 3–8 × 2–4 cm, base rotund to broadly cuneate, adaxially glabrous, abaxially short brown-hispid.

This new variety is readily distinguished from the other varieties of *Gaultheria dumicola* by having densely brown-hirsute juvenile and adult branches. All of the remaining varieties of *G. dumicola* have glabrous leaves, except for variety *aspera* Airy-Shaw, which has abaxially hispid leaf blades.

Gaultheria griffithiana Wight var. **insignis** R. C. Fang, var. nov. TYPE: China. SE Xizang: Zayu Xian, 2800 m, 18 July 1973, *Qinghai-Xizang Complex Exped. 73-781* (holotype, KUN; isotype, PE).

A var. *griffithiana* recedit rhachidibus robustis, lanuginosis; pedicellis robustis, tomentosis; bracteis rotundo-ovatis, 5–7 mm longis, extus inferne et intus omnino densissime sericeis; calycibus intus densissime sericeis.

Plants robust, 1–1.2 m tall. Stems narrowly winged. Leaf blade oblong or narrowly ovate, 13–14 × 4.5–6 cm, base subcordate, apex short caudate. Racemes 4–5 cm long; rachis robust, lanuginose; pedicels robust, 6–9 mm long, tomentose; bracts fulvous, rotund-ovate, 5–7 mm long, densely sericeous adaxially and abaxially below.

Gaultheria griffithiana var. *insignis* is most easily distinguished from variety *griffithiana* by having lanuginose rachises, tomentose pedicels, densely sericeous bracts and calyx interiors, and subcordate bases of the leaf blades. By contrast, variety *griffithiana* has pubescent rachises and pedicels, subglabrous bracts and calyx interiors, and obtuse-rounded bases of the leaf blades.

Gaultheria heteromera R. C. Fang, sp. nov. TYPE: China. Xizang: Medog Xian, 3900 m, 1 Aug. 1974, *Qinghai-Xizang Complex Exped. 74–3876* (holotype, KUN; isotypes, KUN, PE). Figure 2.

Species nova *G. prostratae* W. W. Smith affinis, sed calycibus tetrasepalis, corollis globoso-urceolatis, ramulis puberulis et hirtellis. A *G. pyrolaefolia* J. D. Hooker ex C. B. Clarke foliis parvioribus, ovariis hispidulis, calycibus tetrasepalis differt.

Small shrubs, ca. 10 cm tall. Stems procumbent, terete, slender, branchlets densely puberulent mixed with long brown hairs. Leaves scattered along stem; petioles ca. 1 mm long, glabrous or sparsely hirtellous; leaf blades elliptic, 0.8–1.7(–2.5) × 0.6–1 cm, chartaceous, base broadly cuneate, margin dentate, teeth apiculate, apex obtuse to acute, mucronulate, both surfaces drying brown, glabrous or sparsely hirtellous abaxially; veins slender, secondary ones in 3 pairs, ultimate veinlets conspicuous, all immersed adaxially, raised abaxially. Inflorescences shortly racemose, terminal or axillary on branchlet apices, 1–4-flowered; rachis 3–6 mm long, puberulent; bracts broadly ovate, 1.5–2 mm long, glabrous. Pedicels 4–6 mm long, puberulent; bracteoles 1 or 2 pairs, at middle or upper part of pedicel, somewhat remote from calyx, ovate, 1–1.5 mm long, glabrous. Calyx glabrous; lobes 4, triangular-ovate, 2.5–3 mm long. Corolla white, globose-urceolate, ca. 4 mm long, glabrous abaxially; lobes 4, very short, reflexed. Stamens 8 or 9, ca. 2 mm long; filaments dilated basally, glabrous, papillose; theca 2-aristate. Ovary hispidulous. Capsule unknown.

Distribution and ecology. China, southeastern Xizang. Alpine cushion thicket meadows; ca. 3900 m.

Gaultheria heteromera is closely related to *G. prostrata* W. W. Smith from which it differs by having a 4-lobed calyx, a globose-urceolate corolla,

Figure 2. *Gaultheria heteromera* R. C. Fang. —A. Habit. —B. Flower with two pairs of bracteoles. —C. Abaxial leaf surface. —D. Opened calyx showing pistil. —E. Stamen ventral view. —F. Stamen dorsal view. Scale bars: A = 1 cm, B, D–F = 1 mm, C = 5 mm. Drawn from holotype (*Qinghai-Xizang Complex Exped. 74-3876*).

and puberulent and hirtellous branchlets. *Gaultheria prostrata* has a 5-lobed calyx, a broadly campanulate corolla, and pubescent branches that become glabrescent and cinereous with age. *Gaultheria heteromera* differs from the closely related *G. pyrolaefolia* in having smaller leaves (0.8–1.7(–2.5) × 0.6–1 cm vs. 1.3–5 × 0.8–2.5 cm), a 4- instead of 5-lobed calyx, and hairy instead of glabrous ovary.

Paratypes. CHINA. **Xizang:** Medog, *Qinghai-Xizang Complex Exped. 74-3896* (KUN, PE).

Gaultheria jingdongensis R. C. Fang, sp. nov. TYPE: China. WC Yunnan: Jingdong Xian, 2700 m, 1 May 1959, *S. G. Wu 4774* (holotype, KUN; isotype, KUN). Figure 3.

Proxima *G. trichophyllae* Royle, sed foliis majoribus, subtus dense hispidulis, margine setis caducis, floribus persaepe majoribus, lobis calycis 3–5 mm longis, dense ciliolatis, corollis 6–9 mm longis, profunde divisis, lobis 3–6 mm longis differt.

Small shrubs, ca. 15 cm tall. Stems slender, terete, slightly prostrate, densely cinnamon- or brown-hirsute. Petioles 1–2 mm long, hirsute; leaf blades obovate-oblong, 1–2 × 0.5–1 cm, chartaceous to coriaceous, base cuneate-attenuate, margin denticulate, teeth setose or setae caducous, apex obtuse or rotund, mucronate, adaxially drying brown-green, glabrous, abaxially cinnamon to brown, densely hispidulous; midrib slightly raised below, secondary veins and ultimate veinlets obscure on both surfaces. Flower solitary, axillary; pedicels 2–3 mm long, hirtellous; bracts lacking; bracteoles 2, broadly ovate, ca. 3 mm long, coriaceous, cucullate, close to calyx, glabrous. Calyx lobes unequal, triangular-ovate, 3–5 mm long, densely white ciliolate. Corolla white, 6–9 mm long, deeply 5-lobed; lobes oblong-ovate, 3–6 mm long, erect or apically recurved. Stamens ca. 3 mm long; filaments ca. 1.5 mm long, rhomboid, glabrous, papillose; thecae 1-aristate. Ovary glabrous. Fruit unknown.

Distribution and ecology. China, west-central Yunnan. Shrub forests or roadsides on slopes; ca. 2700 m.

Gaultheria jingdongensis differs from the related *G. trichophylla* in having larger (10–20 × 5–10 mm vs. 5–13 × 2–5 mm) leaves, abaxially densely hispidulous instead of glabrous leaf blades, and caducous setae instead of persistently long-ciliate leaf margins. The flowers are also larger. The densely ciliate calyx lobes are 3–5 mm long instead of glabrous and 2–2.8 mm long. *Gaultheria jingdongensis* also has a larger corolla (6–9 mm vs. ca. 6 mm long) with lobes 3–6 instead of 2–3 mm long.

Paratypes. CHINA. **Yunnan:** Jingdong, *M. K. Li 3545* (KUN), *B. Y. Qiu 52915* (KUN), *Q. A. Wu 9234* (KUN), *Q. A. Wu 9399* (KUN).

Gaultheria leucocarpa Blume var. **psilocarpa** (H. F. Copeland) R. C. Fang, stat. et comb. nov. Basionym: *Gaultheria psilocarpa* H. F. Copeland, Philipp. J. Sci. 47: 62. 1932. TYPE: Philippines. Mindanao, Bukidnon Province, Bur. Sci. 38903, *Ramos & Edano* (holotype, M? (not seen) or PNH? (not seen); isotype, A).

Gaultheria leucocarpa Blume var. **yunnanensis** (Franchet) T. Z. Hsu & R. C. Fang, stat. et comb. nov. Basionym: *Vaccinium yunnanense* Franchet, J. Bot. (Morot) 9: 368. 1895. TYPE: China. Yunnan: Tchen-fong-chan (Cheng-feng-shan), *J. M. Delavay 3069* (holotype, P).

KEY TO THE VARIETIES OF *GAULTHERIA LEUCOCARPA*

1a. Ovary and filaments glabrous; stems sparsely puberulent and glandular-pilose or glabrous; China (Taiwan), Philippines . . . . . var. *psilocarpa* (H. F. Copeland) R. C. Fang
1b. Ovary sericeous, filaments variously hairy; stems glabrous or variously hairy.
2a. Mature fruit white; horns of anther tubes 0.3 mm long; Malay Peninsula, Java . . . . . var. *leucocarpa*
2b. Mature fruit black, blue, or black-purple; horns of anther tubes 0.5 mm long.
3a. Stems and leaves glabrous; China (Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan), Indo-Chinese Peninsula . . . var. *yunnanensis* (Franchet) T. Z. Hsu & R. C. Fang
3b. Stems and flowering branches hairy.
4a. Stems, petioles, rachis or pedicels glandular-hirsute; leaf blade abaxially short-hispid, sometimes adaxially glandular-hirsute, margin setaceous-ciliate; China (Guangxi, C and SE Yunnan) . . . . . var. *crenulata* (Kurz) T. Z. Hsu
4b. Stems with glandular bristles, rachis and pedicels glabrous, leaf blade margin spinulate-serrulate or calloso-serrulate, glabrous; Philippines . . . . . var. *cumingiana* (Vidal) T. Z. Hsu

Gaultheria longibracteolata R. C. Fang, sp. nov. TYPE: China. S Yunnan: Luchun Xian, 1700 m, 17 Sep. 1973, *D. D. Tao 68* (holotype, KUN; isotype, KUN). Figure 4.

Species valde affinis *G. discolori* Nuttall ex J. D. Hook-

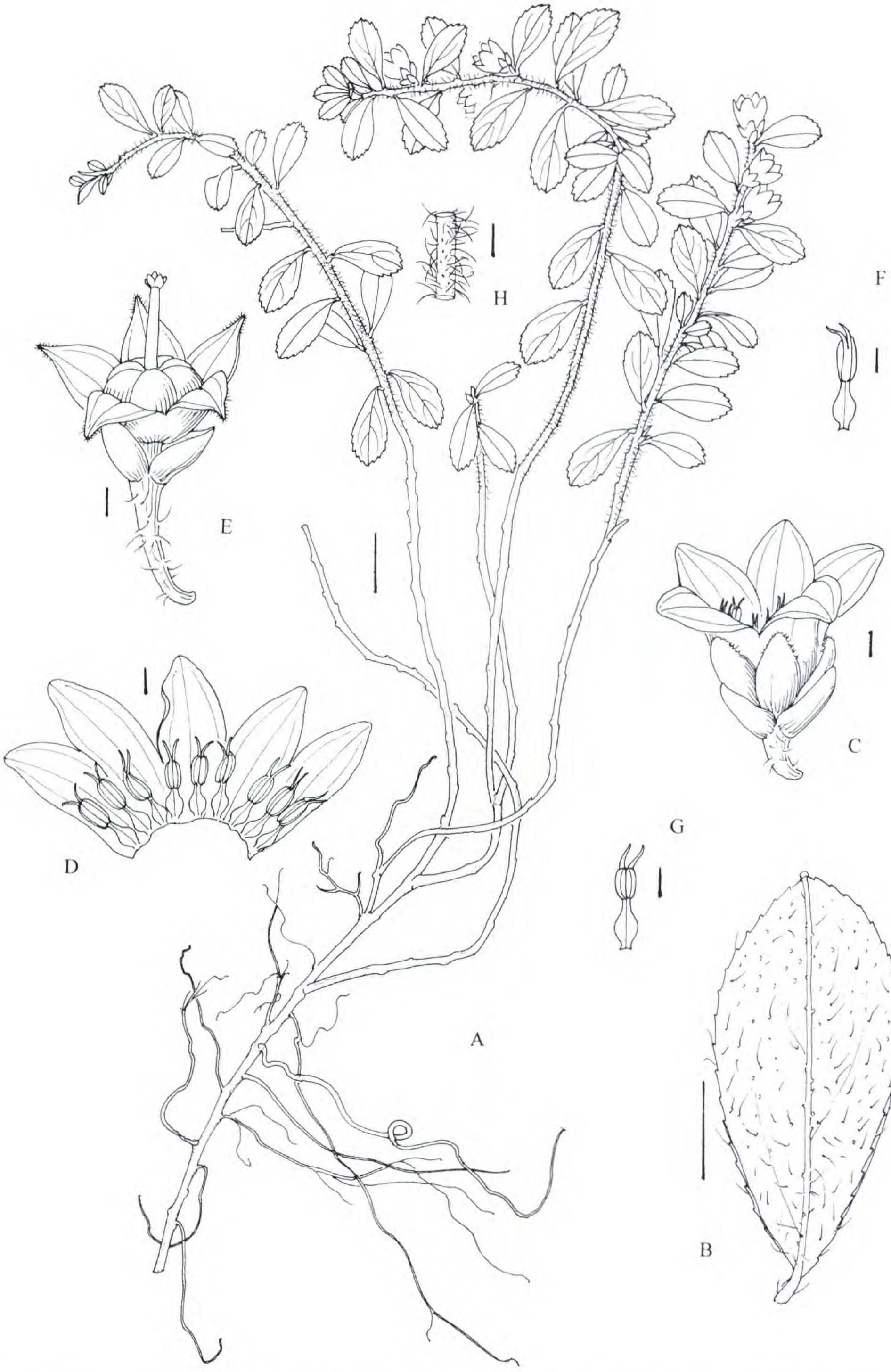


Figure 3. *Gaultheria jingdongensis* R. C. Fang. —A. Habit. —B. Abaxial leaf surface. —C. Flower with bracteoles. —D. Opened corolla showing stamens. —E. Pistil, calyx, and bracteoles. —F. Stamen dorsal view. —G. Stamen ventral view. —H. Portion of stem. Scale bars: A = 1 cm, B = 5 mm, C–G = 1 mm, H = 4 mm. Drawn from holotype (*S. G. Wu 4774*).

Figure 4. *Gaultheria longibracteolata* R. C. Fang. —A. Habit. —B. Abaxial leaf surface. —C. Portion of stem. —D. Flower with bracteoles. —E. Capsule with persistent calyx and bracteoles. —F. Bract. —G. Stamen ventral view. Scale bars: A, B = 1 cm, C = 6 mm, D–G = 1 mm. Drawn from holotype (*D. D. Tao 68*).

er, sed ramulis dense hispidis et puberulis, foliis subtus appresse-setulosis, stylis pilosis, capsulis calycibus carmesinis vel purpureis tectis, aristis antherae 0.8 mm longis, non bicuspidatis differt, et a *G. straminea* R. C. Fang differt foliis ellipticis vel oblongo-ellipticis, bracteolatis calycem subaequantibus, stylis pilosis, capsulis calycibus carmesinis vel purpureis tectis.

Shrubs ca. 50 cm tall. Stems terete, slender angular, densely brown hispid and puberulent. Petioles red, 2–4 mm long, slightly hispid; leaf blades elliptic or oblong-elliptic, 2.5–5 × 1–2 cm, thin coriaceous, base broadly cuneate to obtuse, margin dentate, recurved, apex acute to obutse, mucronulate, adaxially drying gray-green, glabrous, abaxially silvery-white, drying gray-white or pale brown, sparsely and distinctly appressed-setulose; secondary veins 2 or 3 pairs, ultimate veinlets obscure. Inflorescences from axils of upper leaves and terminal, ca. 2.5 cm long; rachis densely pubescent; bracts orbicular-ovate, 4–5 mm long, margin fimbrillate, abaxially subglabrous, adaxially pubescent. Pedicels 3–4 mm long, densely pubescent; bracteoles 2, ovate, similar to bract, ca. 5 mm long, close to calyx. Calyx pink, 4–5 mm long, glabrous abaxially, pubescent adaxially; lobes oblong-ovate, 2.5–3 mm long, ciliolate, apex apiculate. Corolla white, urceolate, ca. 6 mm long, glabrous outside, upper part of inside pilose; lobes ovate-triangular, ca. 0.8 mm long. Stamens 10, ca. 3 mm long; filaments flattened, adaxially glabrous, abaxially pilose; thecae with 2 long aristae ca. 0.8 mm long. Ovary tomentose; style pilose. Fruit globose, ca. 5 mm diam.; capsule enclosed by crimson or purple-green mucronate calyx. Flowering June–September, fruiting August–October.

Distribution and ecology. China (southern Yunnan Province) to Thailand. Evergreen forest margins, on open slopes or among thickets; 1200–2000(–2700) m.

Gaultheria longibracteolata is most closely related to the Bhutanese *G. discolor* Nuttall ex J. D. Hooker and Tibetan *G. straminea* (C. Y. Wu & T. Z. Hsu) R. C. Fang, which it resembles in the outline of the leaf blade, few lateral veins, and grayish white or silvery-white abaxial leaf surface. It differs from *G. discolor* by having densely hispid and puberulent branchlets, abaxially sparsely appressed-setulose leaf blades, pilose styles, and anthers with aristae ca. 0.8 mm long. It differs from *G. straminea* by having elliptic or oblong-elliptic instead of oblong-lanceolate leaf blades, bracteoles almost as long as instead of shorter than calyx, pilose instead of glabrous styles, and capsules enclosed by a crimson or purplish instead of white calyx.

Paratypes. CHINA. **Yunnan:** Yuanyang Xian, Feng Chen Lin, *A. Henry 9460B* (A); without locality, *A. Henry 9460C* (A); Kuan Yin Shan, Red River from Manmei, 6000 ft., *A. Henry 9761* (A); Wenshan Xian, *H. T. Tsai 51543* (A, KUN); Mienning (Lincang Xian), *T. T. Yü 17726* (KUN); Jingdong Xian, *M. K. Li 1792* (KUN); Lincang Xian, *J. S. Xin 601* (KUN); Xingping Xian, *S. G. Wu 474* (KUN); Yuanjiang Xian, *S. G. Wu 761* (KUN); Wenshan Xian, *S. G. Wu 61-3832* (KUN); Mengla Xian, *Z. H. Tsi 91-214* (A); Jingdon Xian, *H. Peng & B. Bai 649* (KUN); Luchun Xian, *S. G. Wu, Y. M. Shui, J. Murata et al. 47, 861, 2577* (KUN, MAK). THAILAND. **Chiang Mai:** Doi, Intanon National Park, *J. F. Maxwell 89-1613* (A).

Gaultheria pseudonotabilis H. Li ex R. C. Fang, sp. nov. TYPE: China. NW Yunnan: Gongshan Xian, Dulongjian region, 1350 m, 9 Mar. 1991, *Dulongjian Bot. Exped. 4446* (holotype, KUN; isotype, KUN). Figure 5.

Species valde affinis *G. notabili* Anthony, sed foliis majoribus, 8–15 × 3–7 cm, basi cordato-rotundatis, floribus rubris, filamentis glabris differt.

Shrubs 1–2(–3) m tall. Stems terete, densely and patently ferrugineous-setose, setae 2–5 mm long. Petioles 3–7 mm long, densely and patently ferrugineous-setose; leaf blades elliptic-ovate, ovate, or oblong-lanceolate, (5–)8–15 × 3–7 cm, chartaceous-coriaceous, base shallowly cordate to rounded, margin sparsely dentate, slightly revolute, densely setiform-ciliate, apex acuminate, caudate, or acute, adaxially bullate, glabrous, abaxially sparsely long setose along midrib and secondary veins, otherwise glabrous; veins adpressed adaxially, distinctly raised abaxially, secondary veins in 2 pairs arising from leaf base. Inflorescences shortly corymbose-racemose, axillary; rachises 2–8 mm long, glabrous; bracts leathery, rhomboid-triangular, 2–4 mm long, glabrous, ciliolate. Pedicels 0.8–1.2 cm long, glabrous; bracteoles 2, basal, similar to bracts but smaller. Calyx cupular, 4–5 mm long; lobes triangular, 2.5–3 mm long, glabrous. Corolla red, broadly campanulate, 7–9 mm long, glabrous outside; lobes triangular-ovate, 3–5 mm broad. Stamens 10, 3–4 mm long; filaments 1.5–2 mm long, glabrous, papillose, base dilated; thecae 2–2.5 mm long, shortly 2-aristate. Ovary glabrous. Fruit depressed globose, ca. 5 mm diam.; capsules enclosed by dark purple calyx. Flowering March, fruiting May.

Distribution and ecology. China, northwestern Yunnan Province. Under evergreen broad-leaved forest, on rocks or among thickets; 1300–2000 m.

Gaultheria pseudonotabilis is allied to and more robust than *G. notabilis* Anthony. Most of the essential characters and geography of the two are basically the same. *Gaultheria notabilis* is a subshrub

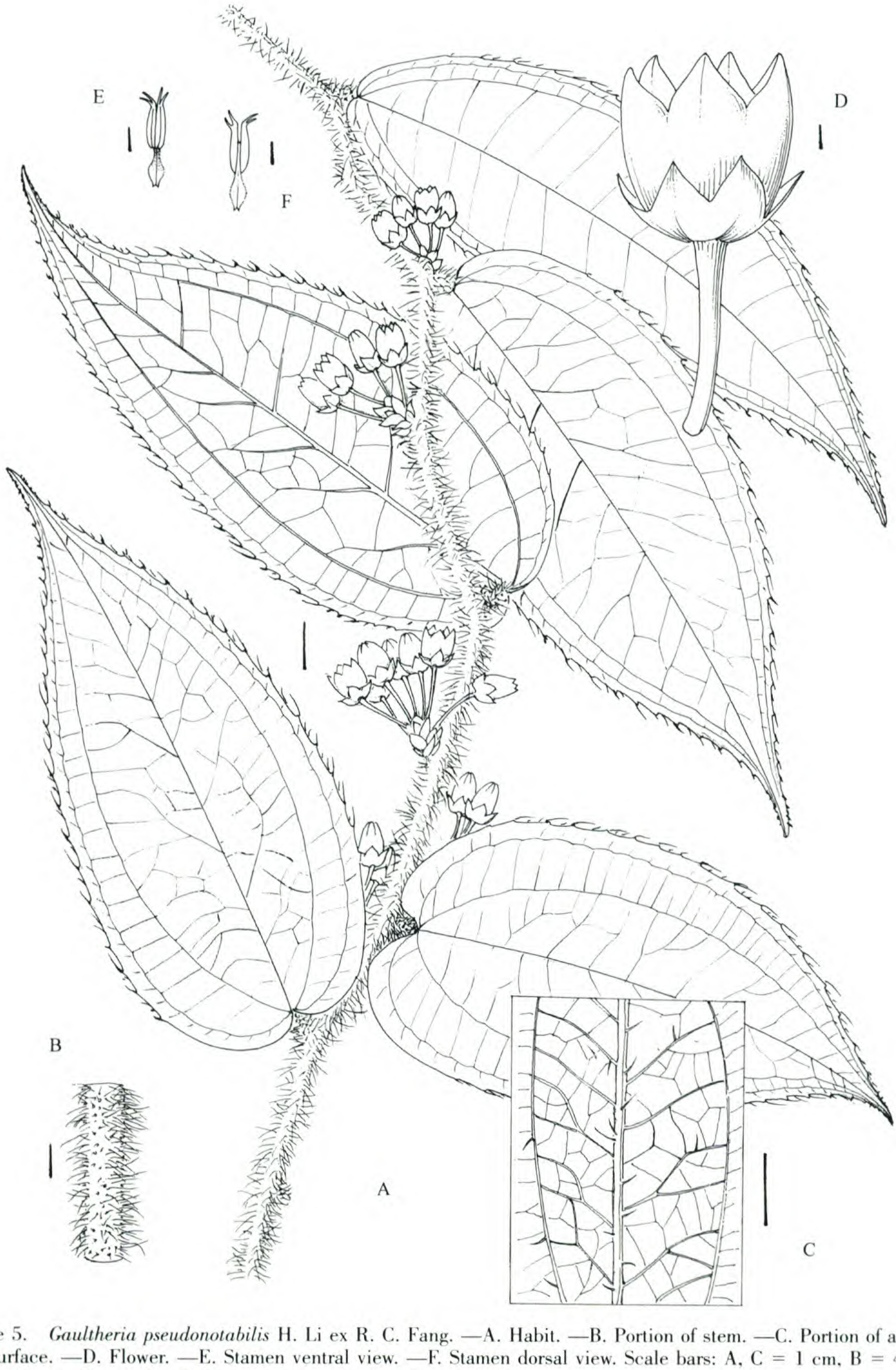


Figure 5. *Gaultheria pseudonotabilis* H. Li ex R. C. Fang. —A. Habit. —B. Portion of stem. —C. Portion of abaxial leaf surface. —D. Flower. —E. Stamen ventral view. —F. Stamen dorsal view. Scale bars: A, C = 1 cm, B = 4 mm, D–F = 1 mm. Drawn from holotype (*Dulongjian Bot. Exped. 4446*).

30–40 cm tall with leaves 2–3.5 × 1.5–2 cm, bracts 1–2 mm long, pedicels ca. 6 mm long, calyx lobes ca. 3 mm long, and corolla lobes 2–3 mm long. *Gaultheria pseudonotabilis* can be separated from the related *G. codonantha* Airy-Shaw by its adaxially glabrous instead of densely short setulose leaf blades, abaxially sparsely long setose instead of very densely ferrugineous-setulose especially along the midrib and secondary veins, glabrous instead of densely tomentose bracts and inflorescence rachises, short (2–8 mm vs. 10–40 mm) rachises, and red instead of white flowers.

The name *Gaultheria pseudonotabilis* first appeared as a nomen nudum in Li (1993), and is herein validated.

Paratypes. CHINA. **Yunnan:** Gongshan Xian, *K. M. Feng 24731* (KUN), *Q. Lin & X. F. Deng 79-1170* (KUN), *Qinghai-Xizang Complex Exped. 8144* (KUN, PE), *Dulongjian Bot. Exped. 915, 3149, 3406, 4152, 4115, 4208, 4231, 4634, 4669, 5395, 6738, 7013* (KUN).

Gaultheria purpurea R. C. Fang, sp. nov. TYPE: China. Xizang: Medog Xian, 2400 m, 2 Dec. 1982, *B. S. Li & S. Z. Cheng 1994* (holotype, KUN; isotype, PE). Figure 6.

Haec species differt a congeneris foliis in sicco subtus purpuratis, secus costas, nervos laterales et reticulationes dense hirsutis, racemis summis caulis, pedunculis 3.5–4.5 cm longis.

Shrublets, 5–10 cm tall. Stems procumbent, terete, slender, branchlets slightly puberulent, densely brown hirsute. Leaves scattered; petioles 1–2 mm long, hirsute; leaf blades elliptic, 1.5–3 × 1–2 cm, coriaceous, base broadly cuneate to rotund, margin denticulate, teeth setose, apex obtuse to acute, mucronulate, adaxially drying gray-green, glabrous, abaxially purple, hirsute along veins; secondary veins 3–5 on each side of midrib, midrib, secondary veins, and ultimate veinlets immersed adaxially and raised abaxially. Inflorescences racemose, on branchlet apices, terminal or axillary, 5–7 cm long in fruit; peduncle 3.5–4.5 cm long, glabrous; rachises glabrous; bracts ovate, coriaceous, 2–3 mm long, glabrous. Bracteoles 2, at middle or upper part of pedicel, ovate-triangular, ca. 2 mm long, ciliolate. Calyx glabrous; lobes triangular-ovate, 1.5–2 mm long, ciliolate. Corolla and stamens not seen. Ovary hispidulous. Fruit globose, 6–7 mm diam.; capsule enclosed by dark purple fleshy calyx; fruit stalk 4–9 mm long, glabrous. Fruiting November–December.

Distribution and ecology. China (southeastern Xizang). On rocky slopes near the summit of mountain; 2000–3400 m.

Gaultheria purpurea is readily distinguished from the other Chinese species of the genus by having purple, hirsute leaves, terminal or axillary inflorescences on branchlet apices, and peduncles 3.5–4.5 cm long.

Paratypes. CHINA. **Xizang:** Medog, *B. S. Li & S. Z. Cheng 1862* (KUN, PE).

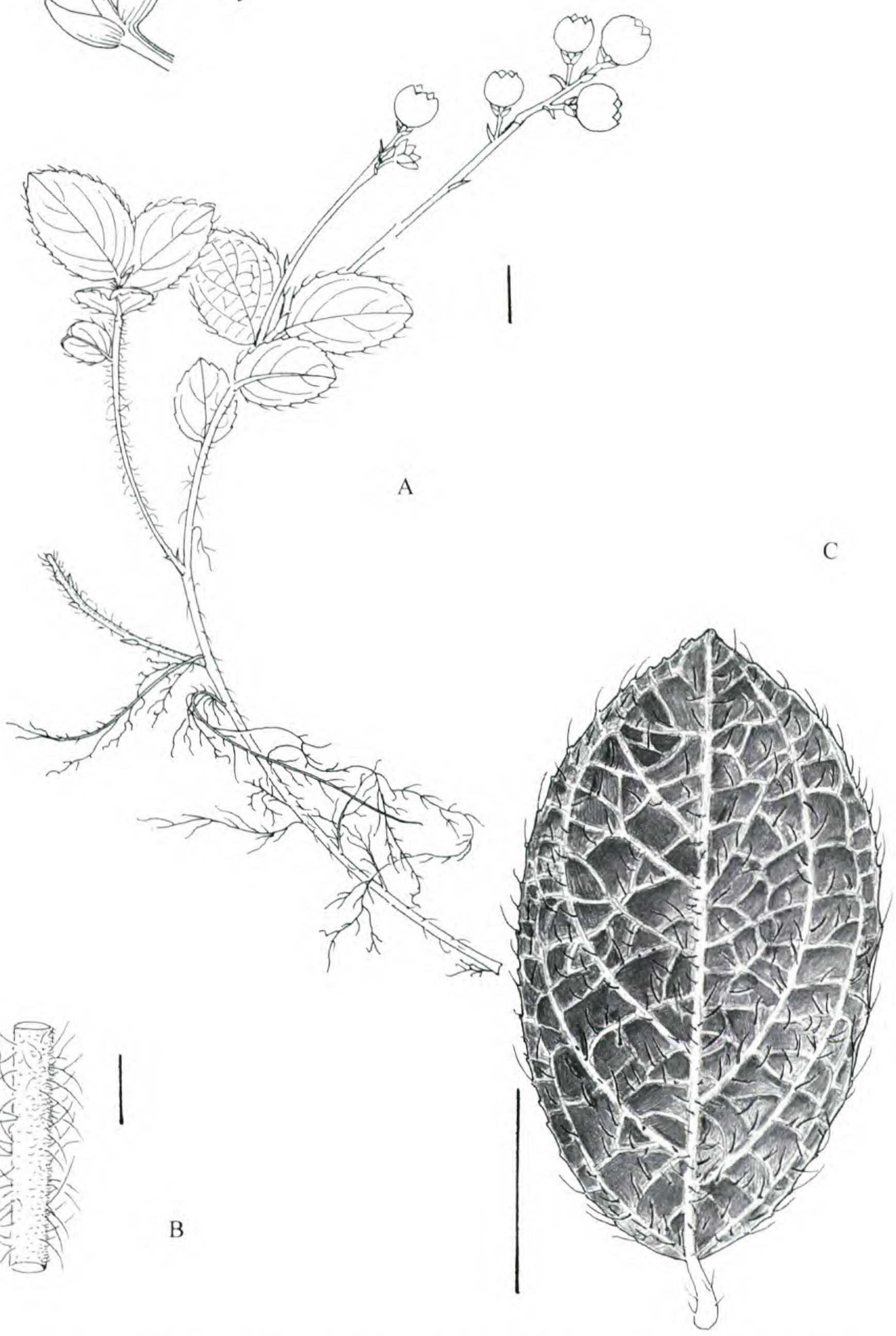
Gaultheria straminea R. C. Fang, nom. nov. Replaced name: *Gaultheria wardii* Marquand & Airy-Shaw var. *serrulata* C. Y. Wu & T. Z. Hsu, Fl. Xizang. 3: 699. 1986; not *G. serrulata* Herzog, Meded. Herb. Leiden 27: 19. 1915; not *G. serrulata* Danguy & Chernt., Bull. Mus. Hist. Nat. Paris 28: 435. 1922. TYPE: China. Xizang: Medog Xian, 1700 m, *Qinghai-Xizang Complex Exped. 73-890* (holotype, KUN). Figure 7.

Shrubs, 1–1.5 m tall. Stems brown, terete; branchlets angular, rather slender, densely brown-hispid and puberulent. Leaves scattered; petiole 4–5 mm long, hispid, puberulent or glabrous; leaf blades oblong-lanceolate or elliptic, 4–7 × 1–2.5 cm, coriaceous, base cuneate or broadly cuneate, margin dentate, apex acuminate or acute, mucronulate, adaxially drying gray-green to dark green, glabrous, abaxially stramineous, appressed setulose; secondary veins 3 or 4 pairs, ultimate veinlets slightly distinct. Inflorescences racemose, axillary and terminal, 1.5–3.5 cm long; rachises densely pubescent; bracts ovate, 3–4 mm long, both surfaces puberulent, ciliolate. Pedicels 1–2 mm long, densely pubescent; bracteoles 2, 2–3 mm long, close but not touching calyx, abaxially puberulent, margins membranous, ciliolate, adaxially glabrous. Calyx ca. 3 mm long, both surfaces puberulent; lobes subulate-triangular, ca. 2 mm long, ciliolate. Corolla white, urceolate, 3–4 mm long, glabrous outside, pilose inside; lobes very short, ovate-triangular. Stamens 10, ca. 1.5 mm long; filaments flattened, spindle-shaped, papillose; thecae short 2-aristate. Ovary tomentose; style glabrous. Fruit globose, 4–5 mm diam.; capsules enclosed by white, rugose calyx. Flowering August–October, fruiting October–March.

Distribution and ecology. China, Xizang. Flood plains, among *Salix* scrub forests, evergreen forest margins or on slopes; 600–2100 m.

Specimens examined. CHINA. **Xizang:** Medog Xian, *Qinghai-Xizang Complex Exped. 1682* (KUN, PE), *Qinghai-Xizang Complex Exped. 74-1712* (KUN, PE), *Qinghai-Xizang Complex Exped. 74-4535* (KUN, PE), *B. S. Li & S. Z. Cheng 973, 1471, 1788, 1907, 2261, 2991, 3125, 3527* (KUN, PE), *H. Sun, Z. K. Zhou & H. Y. Yu 221,*

D



A

C

B

Figure 6. *Gaultheria purpurea* R. C. Fang. —A. Habit. —B. Portion of stem. —C. Leaf abaxial surface. —D. Young capsule with persistent calyx and bracteoles Scale bars: A, C = 1 cm, B = 4 mm, D = 1 mm. Drawn from holotype (*B. S. Li & S. Z. Cheng 1994*).

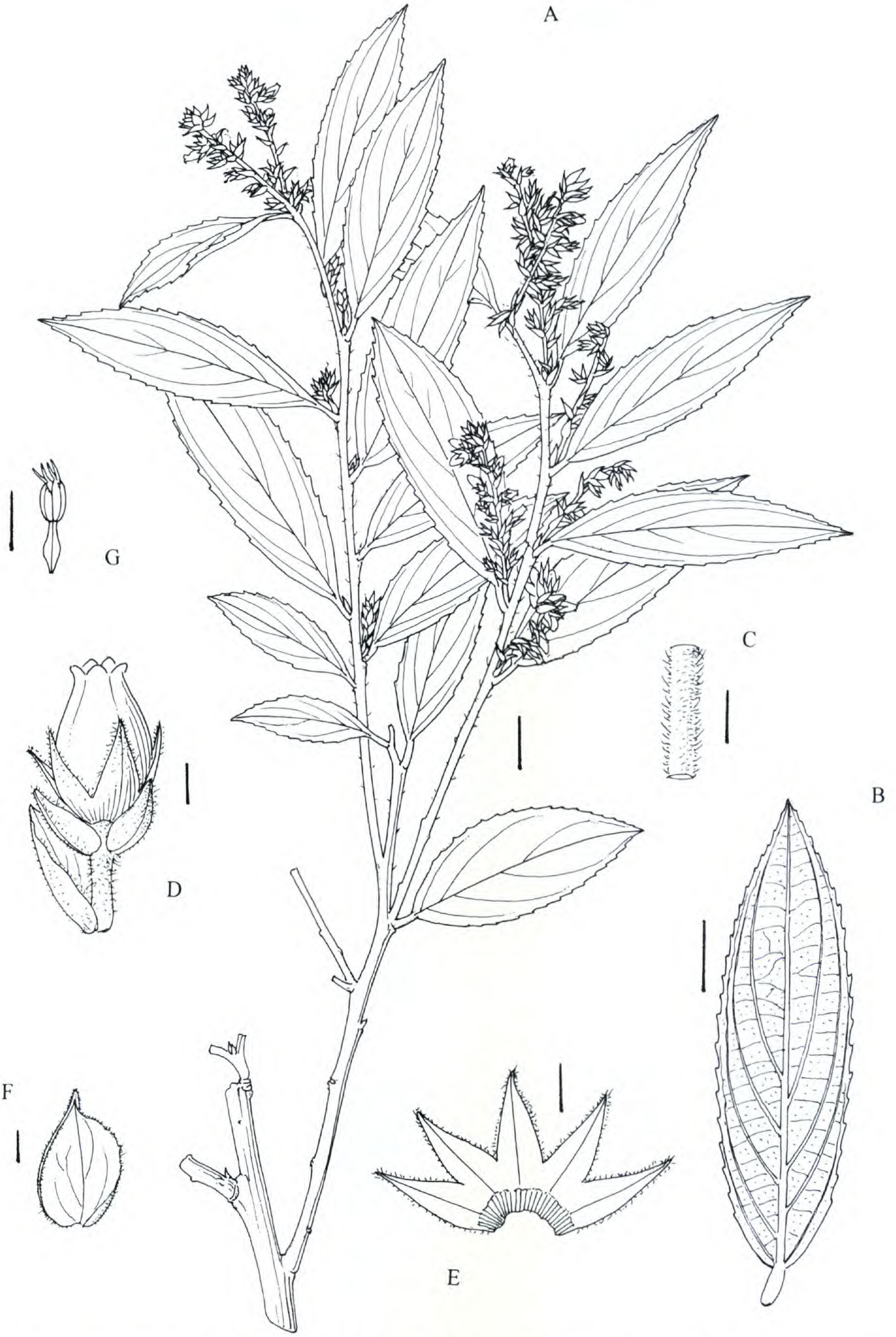


Figure 7. *Gaultheria straminea* R. C. Fang. —A. Habit. —B. Abaxial leaf surface. —C. Portion of stem. —D. Flower with bract and bracteoles. —E. Opened calyx. —F. Bract. —G. Stamen ventral view. Scale bars: A, B = 1 cm, C = 4 mm, D–G = 1 mm. Drawn from *Li & Cheng 973* (KUN).

230, 1832, 2335, 2553, 2787, 4203, 4242, 4872, 6070 (KUN).

Gaultheria straminea is closely related to the Bhutanese *G. discolor* from which it differs in having densely brown-hispid and puberulent branchlets, abaxially appressed setulose leaf blades, 3 or 4 secondary veins on each side of the midrib, densely pubescent rachises and pedicels, and papillose filaments. It can be distinguished from the related *G. longibracteolata* by having the bracteoles at some distance from instead of adjacent to the calyx, subulate-triangular instead of oblong-ovate calyx lobes, glabrous instead of pilose styles, and capsules enclosed by a white and rugose instead of crimson, purplish green, or purple-black glaucous calyx.

Gaultheria trigonoclada R. C. Fang, sp. nov. TYPE: China. Xizang: Medog Xian, 2300 m, 26 Oct. 1992, *H. Sun, Z. K. Zhou & H. Y. Yu 550* (holotype, KUN; isotype, KUN). Figure 8.

Species valde insignis ramulis trigonis usque ad alatos, glabris, foliis rhombico-ellipticis vel ellipticis, nervis lateralibus 2-jugis, inflorescentiis foliis multo brevibus, floribus densis, bracteis et bracteolatis carinatis, 1 costis omnibus.

Shrubs, 1–2 m tall. Stems brownish, slightly 3-angled, branchlets distinctly 3-angled or with narrow wings, glabrous. Petioles 5–10 mm long, glabrous; leaf blades elliptic or rhombic-elliptic, 4–8.5 × 2.5–4 cm, thick coriaceous, base cuneate, margin dentate, apex acute to acuminate, adaxially glabrous, abaxially sparsely shortly brown glandular-setose; secondary veins 2 on each side of midrib, ultimate veinlets subparallel, impressed adaxially, raised abaxially. Inflorescences racemose, axillary, 2–3 cm long; rachis angular, densely pubescent; bracts ovate-lanceolate, carinate, 5–6 mm long, coriaceous, distinctly 1-costate, both surfaces glabrous or puberulent abaxially. Pedicels 2–4 mm long, pubescent; bracteoles 2, similar to bracts, ovate, ca. 3 mm long, close to calyx. Calyx 2.5–3 mm long, divided to near base; lobes triangular-lanceolate, glabrous. Corolla white, urceolate, ca. 5 mm long, glabrous outside, pilose inside; lobes triangular-ovate, ca. 0.5 mm long. Stamens 10, ca. 2 mm long; filaments flattened, dilated below middle, papillose; thecae with 2 slender aristae. Ovary tomentose; styles as long as stamens. Capsules globose, 4–6 mm diam., enclosed by a purple calyx. Flowering October, fruiting June–August.

Distribution and ecology. China, southeastern Xizang. Forests, river terraces among thickets; 2000–2300 m.

Gaultheria trigonoclada is readily distinguished from the other Chinese species of the genus by its trigonous or winged, glabrous branchlets, rhombic-elliptic or elliptic leaves with 2 secondary veins on each side of the midrib, short and densely flowered inflorescences, and carinate, 1-costate bracts and bracteoles.

Paratypes. CHINA. **Xizang:** Medog, 2300 m, 3 Aug. 1974, *Qinghai-Xizang Complex Exped. 74-3955* (KUN, PE), *B. S. Li & S. Z. Cheng 5081* (KUN, PE).

Gaultheria wardii Marquand & Airy-Shaw var. **elongata** R. C. Fang, var. nov. TYPE: China. Yunnan: Gongshan Xian, 2000 m, 28 July 1982, *Qinghai-Xizang Complex Exped. 8858* (holotype, KUN; isotypes, KUN, PE).

A var. *wardii* rhachidi elongata, floribus vel fructibus distantibus in rhachidi, rhachidi visibili, calycibus glabris extra, bracteis et bracteolis subglabris differt.

Gaultheria wardii var. *elongata* differs from variety *wardii* by its elongated rachises, flowers or fruits distant and the rachises distinctly visible, and calyx, bracts, and bracteoles subglabrous abaxially. By contrast, variety *wardii* has shortened rachises, crowded flowers and fruits and the rachises invisible, and calyx, bracts, and bracteoles densely sericeous or velutinous abaxially.

Paratypes. CHINA. **Yunnan:** Gongshan Xian, *T. T. Yü 21060* (KUN), *Qinghai-Xizang Complex Exped. 8925* (KUN, PE); Dulongjian Valley, *Dulongjian Bot. Exped. 826, 1087, 1368, 1441, 1608, 1941, 3210, 4255, 4788, 4955, 5082, 5160, 6981* (KUN).

Vaccinium rubescens R. C. Fang, sp. nov. TYPE: China. W Yunnan: Ximeng Xian, 2000 m, 8 Mar. 1958, *Y. C. Du D580156* (holotype, KUN; isotype, KUN). Figure 9.

Species nova *V. ardisioidi* J. D. Hooker & C. B. Clarke valde affinis, sed foliis oblongo-lanceolatis vel oblongo-ovatis, pedicellis rubris et clavatis, corollis rubris, tubulosis, filamentis pubescentibus, antheris calcaribus valde brevibus differt.

Evergreen shrubs, almost glabrous, terrestrial or epiphytic, 1–2 m tall. Branchlets terete. Leaves 3–8 in pseudoverticils, sessile; leaf blades oblong-lanceolate or oblong-ovate, 7.5–12 × 2–4 cm, chartaceous, base narrowly obtuse-rotund, subcordate, margin entire, apex acuminate; secondary veins slender, more than 15 on each side of midrib, midrib raised on both surfaces. Inflorescences racemose, 2- or 3-umbelled in whorl of leaves, 7–12 cm long, flowers numerous, secund; rachises red, angulate-winged; bracts and bracteoles wanting. Pedicels red, clavate, ca. 1.5 cm long, thickened

Figure 8. *Gaultheria trigonoclada* R. C. Fang. —A. Habit. —B. Portion of stem. —C. Inflorescence in flower showing bracts. —D. Flower with bract and bracteoles. —E. Stamen ventral view. —F. Stamen dorsal view. —G. Capsule enclosed by calyx. Scale bars: A–C = 1 cm, D–G = 1 mm. Drawn from holotype (*H. Sun, Z. K. Zhou & H. Y. Yu 550*).

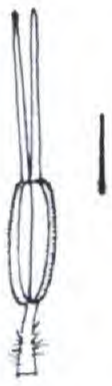
Figure 9. *Vaccinium rubescens* R. C. Fang. —A. Habit. —B. Flower. —C. Opened corolla showing stamens. —D. Berry. —E. Stamen ventral view. —F. Stamen dorsal view. Scale bars: A = 1 cm, B, C, E = 1 mm, D = 2.5 mm. A–C, E, F drawn from holotype (*Y. C. Du D580156*), D drawn from *Li 4983* (KUN).

B

A

E

D



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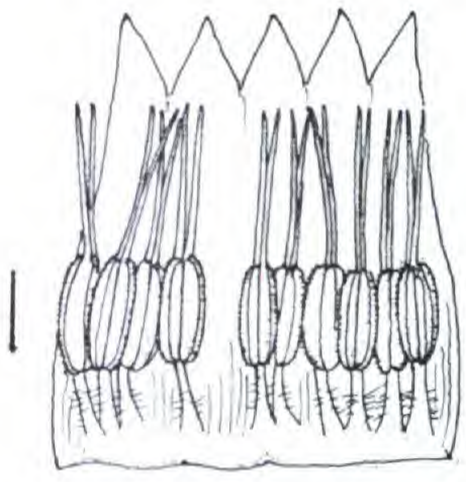

Figure 10. *Vaccinium tenuiflorum* R. C. Fang. —A. Habit. —B. Flower bud. —C. Opened corolla showing stamens. —D. Stamen ventral view. —E. Stamen dorsal view. Scale bars: A = 1 cm, B–E = 1 mm. Drawn from holotype (*H. Sun, Z. K. Zhou & H. Y. Yu 2617*).

upward, distinctly articulated with calyx. Calyx tube shortly terete, ca. 4 mm long, upper parts free, not adnate to ovary; teeth triangular, ca. 1 mm long. Corolla orange to pink, tubular, 7–8 mm long; teeth less than 1 mm long. Stamens 10, 5–7 mm long; filaments 2–4 mm long, pubescent especially at apex; anthers spinulose, with 2 short spurs; tubules as long as thecae. Berry globose, scarlet, ca. 5 mm diam.; fruit stalk scarlet, ca. 2 cm long. Flowering March, fruiting May.

Distribution and ecology. China, western Yunnan. Dense forests, roadsides, moist places; 2000–2200 m.

Vaccinium rubescens is most closely related to *V. ardisioides* J. D. Hooker ex C. B. Clarke from which it can be distinguished by the oblong-lanceolate or oblong-ovate instead of the ovate or elliptic leaves, red and clavate instead of purple and slender pedicels, orange or pink and tubular instead of white-green and urceolate-tubular corollas, pubescent instead of subglabrous filaments, and shortly 2-spurred instead of spurless anthers.

Paratypes. CHINA. **SW Yunnan:** Luxi Xian, *H. T. Tsai 56424* (KUN); Gengma Xian, *P. Y. Mao 5574* (KUN), *Y. H. Li 4983* (KUN).

Vaccinium tenuiflorum R. C. Fang, sp. nov. TYPE: China. SE Xizang: Medog Xian, 1800 m, 26 Dec. 1992, *H. Sun, Z. K. Zhou & H. Y. Yu 2617* (holotype, KUN; isotype, KUN). Figure 10.

Species nova *V. vacciniacei* (Roxburgh) Sleumer valde affinis, sed foliis coriaceis non chartaceis, 4–11 × 0.9–2 cm, pedicellis usque ad tubos calycum dense pubescentibus, corollis albis, anguste-tubulosis differt.

Evergreen shrubs or climbers. Branches scabrous, juvenile ones pubescent and shortly glandular-setose, with scattered lanceolate leaf bud scales. Leaves 9 or 10 in pseudoverticils; petioles 1–2 mm long, juvenile pubescent; leaf blades lanceolate to oblong-lanceolate, 4–11 × 0.9–2 cm, coriaceous, base narrowly cuneate or rotund, margin sparsely serrate, recurved, apex acuminate, adaxially drying dull green, abaxially olive green, both surfaces glabrous, juvenile puberulent along midrib, secondary veins 12 or 13 on each side of midrib. Inflorescences from top of branches, axillary, racemose, 5–6 cm long; rachises slender, densely pubescent, with numerous lanceolate flower bud scales at base; bracts lanceolate, 2–3 mm long, puberulent, ciliolate. Pedicels slender, 5–6 mm long, densely pubescent, slightly thickened upward, articulated with calyx; bracteoles 2, linear, ca. 1 mm long. Calyx 2–2.8 cm long, tube densely pubescent; teeth 1–1.8 mm long, triangular, pubescent or glabrous, 1-veined. Corolla white, narrowly tubular, 4–5 mm long, both surfaces glabrous except 5 pubescent ridges outside; lobes triangular, ca. 0.6 mm long. Stamens 10, shorter than corolla; filaments 0.8–1 mm long, flattened, widened at base, glabrous; anthers spinulose, without spurs, tubules longer than thecae. Berry subglobose, ca. 3 mm diam. Flowering December, fruiting April.

Distribution and ecology. China, southeastern Xizang. In forest, ca. 1800 m.

Vaccinium tenuiflorum is closely related to *V. vacciniaceum* (Roxburgh) Sleumer, from which it can be distinguished by having coriaceous leaves, densely pubescent pedicels and calyx tubes, and white and narrowly tubular corollas. *Vaccinium vacciniaceum* has chartaceous leaves, glabrous pedicels and calyx tube, and greenish yellow urceolate corollas.

Paratype. CHINA. **Xizang:** Medog Xian, *H. Sun, Z. K. Zhou & H. Y. Yu 5142* (KUN).

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Asclepias jorgeana (Asclepiadaceae), a New Milkweed from Montane Western Mexico

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ABSTRACT. A new milkweed, *Asclepias jorgeana*, from pine-oak forests of Chihuahua, Sonora, Durango, and Guanajuato, Mexico, is described and illustrated. It appears to be related to *A. pringlei* (Greenman) Woodson, which occurs mostly to the south and east of *A. jorgeana*; however, they occur sympatrically in Durango. The new species is distinguished from *A. pringlei* by attenuate corona hoods, erect, fusiform follicles, and comose seeds. Although the new species has been collected several times since 1946, specimens have remained unidentified or have been determined to be hybrids or an undescribed species.

In preparing a treatment of Asclepiadaceae for the revision of Howard Scott Gentry's *Rio Mayo Plants* (Martin et al., 1998), the first author examined several collections of *Asclepias* that could not be assigned to any known species. Contemporaneously, the second author also determined that several herbarium specimens under study from Durango represented an undescribed species of *Asclepias*. Independent study of this plant in the field by both authors and subsequent discussions confirmed the identity and distinctiveness of these populations, which we describe here as a new species.

Asclepias jorgeana Fishbein & S. P. Lynch, sp. nov. TYPE: Mexico. Chihuahua: Cascada de Basaseáchic, 28°10′20″N, 108°13′W, 1950 m, approx. 100 m upstream from the top of the falls, above the trail, on steep, shaded, moist, SE-facing, rocky slope, 5 July 1994, *M. Fishbein 1789, S. McMahon, G. Ferguson, R. Felger, M. Wilson* (holotype, ARIZ; isotype, MEXU). Figure 1A–H.

Herba e radice fibrosa. Caulis simplex erectus. Folia opposita petiolata parce puberula; lamina elliptico-ovali vel ovata, maxima 45–123 mm longa, 15–61 mm lata; petiolo 5–16 mm longo. Umbellae 1–5 extra-axillares vel ut videtur terminales, 7–26-florales; pedunculo 10–40 mm longo; pedicello 12.5–22.5 mm longo. Calyx viridis; lobis reflexis, 1.75 mm longis. Corolla viridis saepe obscure roseolo-brunnea suffusa; lobis reflexis, 4.75–6.5 mm longis. Corona e 5 cucullis pallido-lavandulis vel albis, stipitatis fere erectis, 3.75–4.75 mm longis composita. Corniculi ad medium cucullis adnati, arcuati exserti. Columna 0.8–1.25 mm longa. Folliculus erectus in pedicello reflexo, fusiformis. Semina ovalia comosa.

Perennial herb 20–50 cm tall from fibrous rootstock. Stem single from base, unbranched, puberulent in lines or hairs scattered around the stem. Leaves opposite, decussate, simple; lowest pair 17.5–62.5 mm long and 10–27.5 mm wide, the largest 45–123 mm long and 15–61 mm wide, becoming reduced and subsessile in the inflorescence; blades elliptic-oval to ovate, the apex acute, the margin entire, ciliate, decurrent on the petiole (especially pronounced in southern populations; Fig. 1A), the base acute to rounded, appearing subcordate in southern populations (Fig. 1A), puberulent on veins below, sparsely pubescent throughout above, the venation reticulodromous, with 3–10 tan to dark brown, glandular, multicellular trichomes ("colleters") borne at the base of the midvein above, membranous, bright green above, paler below; petioles 5–16 mm; stipules absent, several glands (colleters) similar to those on the blade in their position. Inflorescence of 1–5 umbels adjacent to upper leaf axils and also apparently terminal, on peduncles 10–40 mm long; umbels of 7–26 flowers on puberulent pedicels 12.5–22.5 mm long. Flowers hermaphroditic, 10–12.5 mm long from tip of reflexed corolla lobe to corona tip; calyx synsepalous, green, the tube very short, the 5 reflexed lobes 1.75 mm long; corolla sympetalous, green often suffused with dull pinkish brown, the tube short, the 5 reflexed lobes 4.75–6.5 mm long; stamens 5, ad-

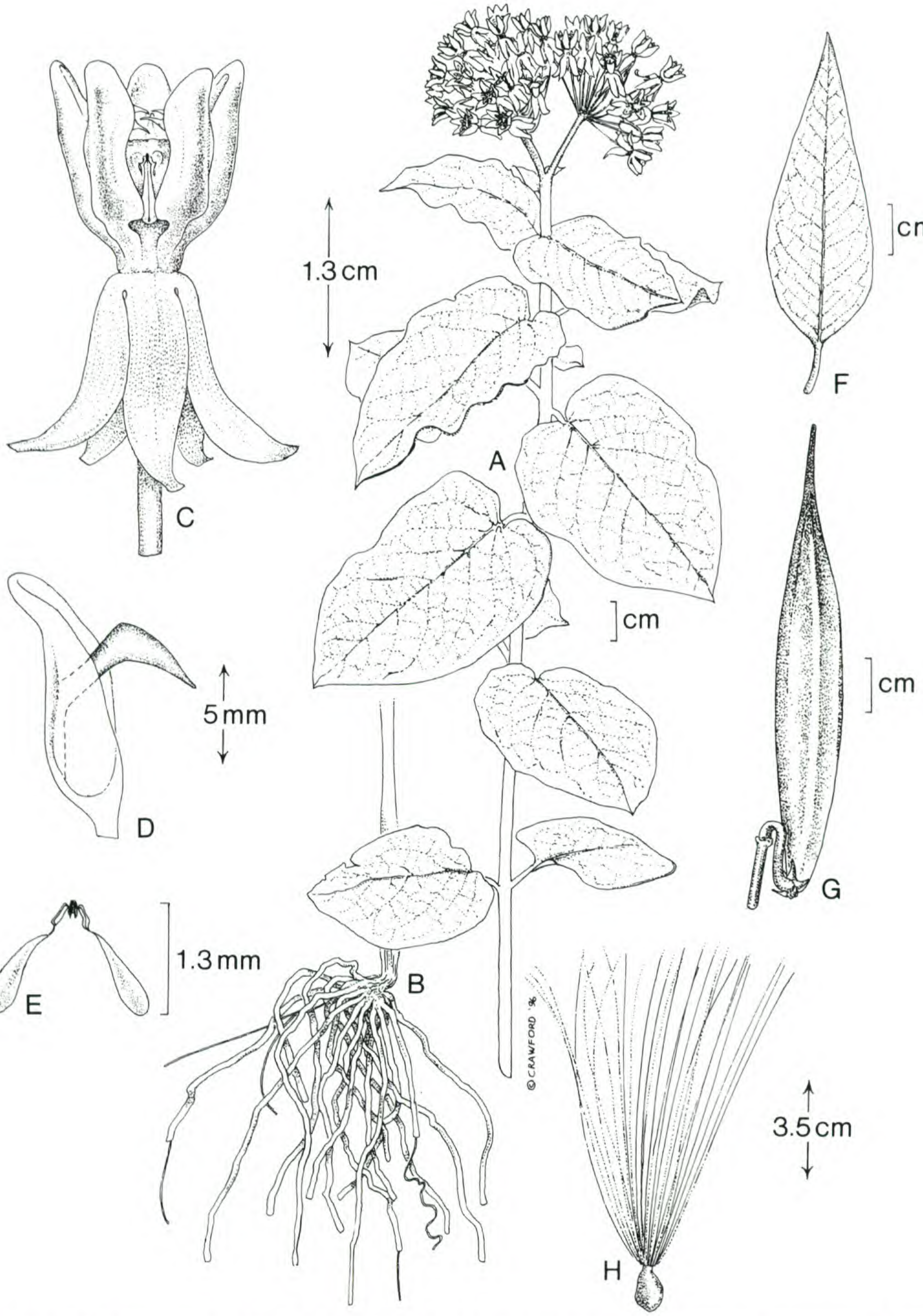

Figure 1. *Asclepias jorgeana* Fishbein & S. P. Lynch. —A. Habit, showing broad leaves characteristic of Durango populations. —B. Roots. —C. Flower. —D. Corona segment (hood with protruding horn), lateral view. —E. Pollinarium. —F. Narrow leaf characteristic of northern populations. —G. Follicle. —H. Seed. Based on *Lynch 14175* (LSUS), *Fishbein 1789* (ARIZ, MEXU), and photos.

nate to the common style apex of the two carpels to form a gynostegium, the column composed of connate stamen filaments 0.8–1.25 mm long, cylindric or slightly obconic; corona of 5 distinct segments (hoods) arising from the top of the column at the attachment of the anthers, the hoods nearly erect to spreading, stipitate, cup-shaped, dorsally flattened, with entire margin, truncate basally, obtuse and rounded apically, 3.75–4.75 mm long, surpassing the anther-style head, pale lavender to white, bearing a narrowly falcate appendage (horn) within, the horns adnate to hoods from the base to midway up the segment and abruptly curving over the anther-style head, sometimes geniculate near the point of egress from the hood; anther-style head narrowly cylindric, 2.25–2.5 mm long, the anthers bithecous with one fertile cell per theca, bearing corneous marginal appendages (wings) widest at base and scarious, ovate-lanceolate, apical appendages, 0.5 mm long, pollen grains in each anther cell embedded in a waxy matrix forming a pollinium; pollinia lacrimiform, 1.25 mm long, those of adjacent anthers united by a translator with arms 0.3 mm long; gynoecium of 2 carpels, the ovaries free, the styles connate their entire length, abruptly expanded apically and fused to anthers, the stigmas 5, borne below the style apex. Fruits follicular, 8 cm long, fusiform, apically acuminate, borne erect on deflexed pedicels. Seeds narrowly ovate, compressed, narrowly winged, 6.2–6.5 mm long, bearing an apical tuft of bright white hairs 2.5–4.5 cm long.

Etymology. This species is named in honor of George Ferguson, a broadly knowledgeable naturalist who has introduced the first author to many fine places in the Río Mayo region. He has collected several specimens of the new species, which, like George, is at home in the wild, rugged canyons of the pine-oak forest.

Distribution and habitat. *Asclepias jorgeana* is known from west-central Chihuahua and adjacent Sonora, western Durango (prominently along the Durango–Mazatlán highway), and as a disjunct in eastern Guanajuato (Fig. 2). In Chihuahua and Sonora, populations of the new species have been found from ca. 1825–2250 m in pine-oak forest and riparian forest dominated by *Pinus* spp., *Quercus* spp., *Cupressus*, *Abies*, and *Alnus*. At these sites, *A. jorgeana* occurs mainly in the shade of canopy trees in steep ravines and in canyon bottoms along perennial streams. At Pinos Altos, Chihuahua, the species was found on a disturbed hill with little topsoil in sparse vegetation dominated by *Juniperus*. This site is considerably more xeric than the

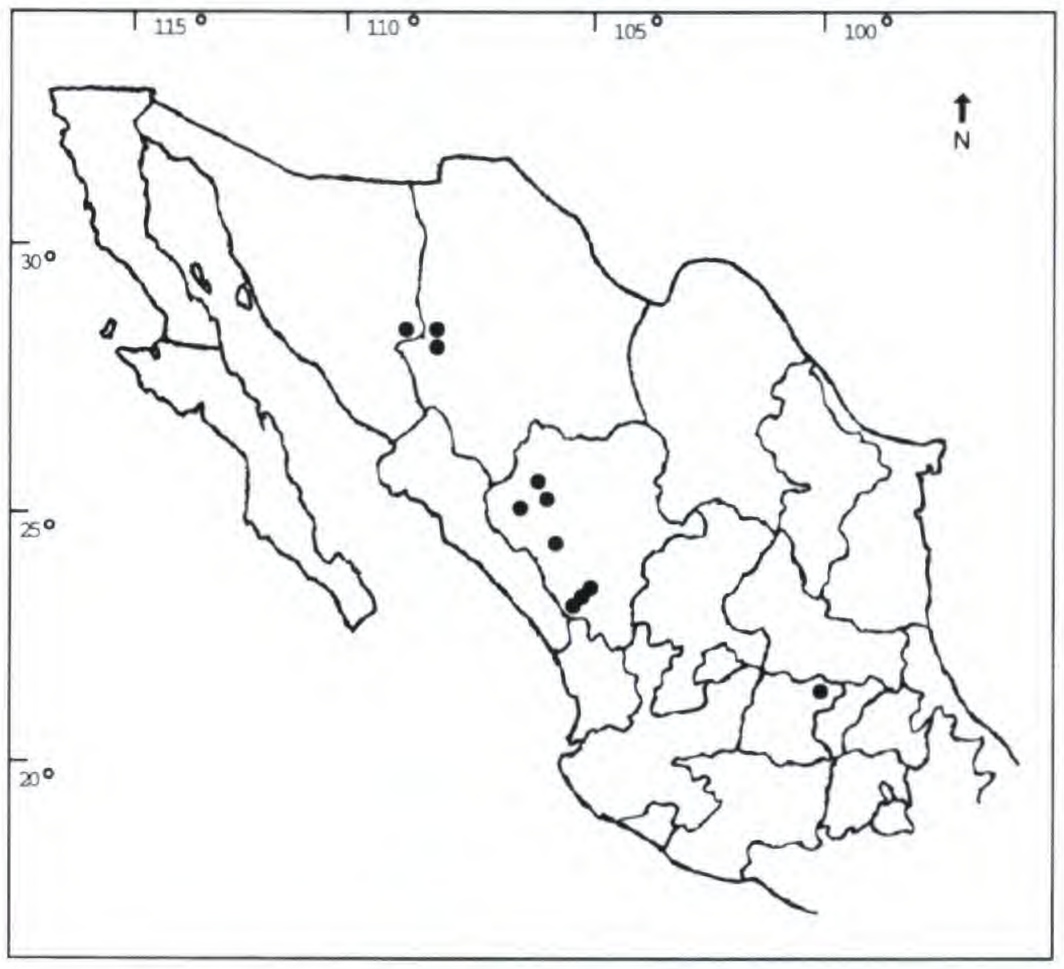

Figure 2. Distribution of *Asclepias jorgeana* in northern and central Mexico.

other known localities and is the site of the only previously collected population in the vicinity of Cascada de Basaseáchic that could not be relocated in 1994.

In Durango, populations of *A. jorgeana* have been found from ca. 1700 to 2525 m in a variety of vegetation types. At the lowest elevations, the new species has been collected at the lower limit of pine-oak forest at the ecotone with tropical deciduous forest or thorn scrub. Along streams at these elevations, it has been found in pine-oak forest with *Abies*. At middle elevations, it has been found in pine-oak forest on canyon slopes and in cloud forest with *Magnolia*. At the highest elevations, *A. jorgeana* has been collected in meadows within pine-oak forest and on steep slopes in mixed conifer forest with *Pinus*, *Abies*, *Cupressus*, and *Pseudotsuga*.

In Guanajuato, *A. jorgeana* has been collected on a hillside at ca. 1835 m. The vegetation at this locality was not reported by the collectors.

Ecology and phenology. *Asclepias jorgeana* is unusual among North American milkweeds by inhabiting dense forest understories rather than more typical open woodland and grassland sites. Other species of *Asclepias* that are found in similar habitats include *A. quadrifolia* Jacquin and *A. exaltata* L. in the eastern United States, *A. similis* Hemsley in eastern and southern Mexico, *A. hypoleuca* (A. Gray) Woodson (sympatric with *A. jorgeana* in Chihuahua and Sonora), and *A. ovata* M. Martens & Galeotti. Presumably these species are tolerant of the shade and acidic soils characteristic of these habitats. Unlike *A. quadrifolia*, *A. exaltata*, *A. similis*, and *A. hypoleuca*, which possess large storage roots that may be advantageous to plants of the for-

est understory (Chaplin & Walker, 1982; M. Fishbein, pers. obs.), *A. jorgeana* has fibrous roots, like *A. ovata* (M. Fishbein, pers. obs.). Despite the lack of large roots, individual plants of *A. jorgeana* have persisted for several years in cultivation (M. Fishbein, unpublished data).

Based on label data, flowering dates for the new species range from late June through August. Southern populations in Durango appear to have a more extended flowering season lasting through August, whereas the latest flowering specimens from Chihuahua were collected on the first of August. Fruiting specimens in Chihuahua and Durango have been collected in mid August.

Several kinds of insects have been observed visiting the flowers of *A. jorgeana* in Chihuahua. Along the Arroyo Durazno, small butterflies of the families Hesperiidae and Lycaenidae were observed. The flowers emitted a strong violet-like scent when these observations were made on a warm sunny morning; during all other field observations, however, no scent could be detected. At several sites in Chihuahua, tiny Diptera or Hymenoptera were observed visiting flowers in great numbers. Among observed visitors, hesperiid and lycaenid Lepidoptera were probably marginally large enough to be effective pollinators of this species, although no pollinia were observed on these visitors (cf. effective pollinators of *A. tuberosa* L., which has flowers comparable in size and shape to those of *A. jorgeana* [Fishbein & Venable, 1996]). We have not observed flower visitors that we deem to be regular, effective pollinators of this species. The small flies were certainly too small to be pollinators, being approximately equal in size to a pollinium.

In Durango, woolly caterpillars (Lepidoptera: Arctiidae) and Queen butterfly caterpillars (Lepidoptera: Danaiidae) were observed feeding extensively on leaves and young fruit. No herbivory was observed at any of the sites in Chihuahua.

Phylogenetic relationships. *Asclepias jorgeana* has stipitate, cup-shaped corona segments that are similar to those of species included by Woodson in subgenus *Asclepias* (Woodson, 1941b, 1954). Within this subgenus, *A. jorgeana* is most similar to species assigned by Woodson (1954) to the heterogeneous series *Syriacae*, *Purpurascentes*, and *Tuberosae*. Among these, *A. jorgeana* is most similar to *A. pringlei* (Greenman) Woodson of series *Syriacae*. The two species are nearly identical in vegetative characteristics, and we have been able to determine only with great difficulty the identity of non-reproductive specimens from areas where the two species co-occur. However, the species are easily distinguished in flower or fruit. Flowers of *A. pringlei* have smaller corona segments (hoods) with less attenuate and more rounded apices. The adaxial hood appendages (horns) of *A. pringlei* are less arching than those of *A. jorgeana* or may be absent altogether. Arching corona horns are present in all specimens of *A. jorgeana* that we have examined. Fruits of *A. pringlei* are distinctive: they are pendulous, ovoid, and have a thick spongy layer in the wall of the follicle. The seeds are also unusual in lacking the apical trichomes (coma) common to most species in the family (cf. *A. perennis* Walter of the southeastern U.S.). *Asclepias jorgeana* produces fruits that are more typical of those of other North American species of *Asclepias*: erect, relatively slender with a long, tapering apex, and thin-walled. The seeds possess a typical coma.

Other species with which *A. jorgeana* shares similar characteristics include *A. variegata* L. (eastern U.S.) and *A. hallii* A. Gray (southwestern U.S.) of series *Purpurascentes* and *A. tuberosa* (widespread in the U.S.) of series *Tuberosae*. *Asclepias variegata* is similar vegetatively, but differs in having compact hemispherical umbels and small hoods with rounded apices reminiscent of those of *A. pringlei*. *Asclepias hallii* is quite similar in floral morphology and coloration, but differs from *A. jorgeana* in bearing alternately arranged, narrowly lanceolate leaves. *Asclepias tuberosa* is also similar in floral morphology, but differs in having brightly colored yellow, orange, or red flowers, branched inflorescences, alternate phyllotaxy, lack of white latex, and densely hirsute vestiture.

Preliminary phylogenetic study of *Asclepias* based on a broad sampling of morphological characters suggests that *A. jorgeana* is a member of a large clade that includes the majority of species comprising subgenus *Asclepias* (Fishbein, 1996a, b, unpublished). Relationships within this large clade are poorly resolved in the analyses of Fishbein (1996a, b, unpublished), with members of series *Syriacae*, *Purpurascentes*, and *Tuberosae* intermingled. In the set of most parsimonious trees, *A. jorgeana* is usually found to be a member of a subclade containing *A. variegata*, *A. hallii*, and *A. tuberosa*. Placement of *A. jorgeana* in this subclade is supported by possession of an attenuate hood apex and appressed anther margins that tightly restrict access to the underlying stigmatic chamber. In some analyses, *A. pringlei* is found to be a member of a closely related subclade, and placement of *A. jorgeana* in the same subclade as *A. pringlei* is only slightly less parsimonious than placement in separate subclades (Fishbein, unpublished). The highly apomorphic fruit characters that readily distinguish *A. pringlei* from *A. jorgeana* do not link *A.*

pringlei with any other species. These characters clearly have arisen independently in other lineages, such as pendulous fruits in the desert shrub *A. subulata* Decaisne, and seeds lacking a coma in *A. perennis*. We consider it likely that more refined analyses of *A. jorgeana* and related species will find a closer relationship between *A. jorgeana* and *A. pringlei*.

Specimens of *Asclepias jorgeana* have been identified previously as *A. ovata*, which occurs sympatrically, but often at lower elevations and in more open habitats (e.g., *Spellenberg 9603*, NMC; *Gentry & Gilly 10615*, MICH; *LeDoux 1947*, ENCB; *Bravo 1076*, IEB). The two species share an erect, unbranched habit with sparse pubescence, ovate membranous leaves, fruits borne erect on deflexed pedicels, and fibrous roots. Compared to *A. jorgeana*, the umbels of *A. ovata* are nearly spherical, rather than flat-topped to nearly hemispherical, and the corona segments are bright white and apically truncate, rather than pale lavender and apically attenuate. Specimens of *A. jorgeana* have also been identified as *A. contrayerba* Sessé & Moçino (= *A. jaliscana* B. L. Robinson; *Maysilles 7434*, MO), *A. glaucescens* HBK (*Warnock 2156*, TEX 2 sheets), and *A. lanuginosa* HBK, non Nuttall (= *A. otarioides* E. Fournier; *Waterfall 13654*, MO). *Asclepias jorgeana* has not been confused with *A. pringlei* by collectors, despite vegetative similarities, probably because they are easily distinguished in flower and fruit. Some specimens of *A. jorgeana* have been determined to represent an undescribed species (e.g., *Pennington 93*, TEX; *Tenorio 1150*, ENCB 2 sheets, MEXU).

Specimens attributable to *A. jorgeana* also have been considered to represent hybrids. A specimen of *A. jorgeana* examined by Woodson (*Maysilles 7434*, MICH) was annotated initially as a putative hybrid between *A. otarioides* E. Fournier (as *A. lanuginosa* HBK) and *A. pringlei* (as *A. humilis* (sic), i.e., *Acerates humilis* Bentham; see Woodson, 1954: 123). Woodson later determined specimens of *A. jorgeana* to be hybrids between *A. otarioides* and *A. ovata* (e.g., *Maysilles 7852*, MICH; *Maysilles 7860A*, MICH; *Maysilles 8477*, MICH). The similarities of *A. jorgeana* to *A. pringlei* and *A. ovata* already have been discussed. However, we find no compelling reason to invoke the parentage of the rather dissimilar *A. otarioides* in the origin of *A. jorgeana*. No evidence of intermediacy exists in locations where *A. jorgeana* is sympatric with *A. otarioides* and *A. pringlei* in Durango or with *A. ovata* throughout its range. We cannot disprove the hybrid origin of *A. jorgeana* with existing data. However, the species is clearly composed of self-reproducing populations with no evident gene flow from the putative parents.

Of other specimens that Woodson (1954: 123) suggested to be part of hybrid swarms between *A. otarioides* and either *A. ovata* or *A. pringlei*, some have been recognized as representing a distinct species, namely, *A. notha* W. D. Stevens (Stevens, 1983, 1985). Others should perhaps be recognized as an additional species endemic to Michoacán, viz., *A. scheryi* Woodson (Woodson, 1941a). Woodson (1954) subsequently included these specimens in his concept of *A. lanuginosa* HBK (= *A. otarioides*). Most of the remaining specimens considered by Woodson (1954) to belong to this complex of putative hybrids were collected in Puebla and Oaxaca and appear to represent yet another species (S. Lynch, unpublished data). Although it may be surprising that a new species of *Asclepias* should be described from North America, it is evident that several more will be named from relatively poorly collected areas in the rugged Mexican sierras.

Paratypes. MEXICO. **Chihuahua:** Cascada de Basaseáchic, 28°10′20″N, 108°13′W, 2000 m, top of falls, 23 July 1986, *P. Jenkins s.n.* (ARIZ); 28°11′W, 108°12′30″N, in sand along the Río Basaseáchic between the campground and the top of the falls, 1 Aug. 1988, *R. Spellenberg 9603, R. Corral, J. Brunt, L. Huenneke* (NMC); Pinos Altos, on trail from Santo Niño shaft to lower tunnel, 28°15′N, 108°17′W, 2075 m, steep moist, W-facing andesitic cliffs, 21 July 1946, *W. P. Hewitt, 144* (TEX); 28°16′20″N, 108°18′10″W, 2250 m, 26 July 1986, *G. Ferguson s.n.* (ARIZ); 1.5 mi. NW of Pinos Altos along road to La Batería, 28°16′40″N, 108°18′40″W, 2100 m, tall pine-oak forest, 27 June 1986, *G. Ferguson s.n.* (ARIZ); 2.0 mi. NW of Pinos Altos along road to La Batería, 28°16′40″N, 108°18′40″W, 2025 m, steep, rocky, N-facing ravine in pine-oak forest, 6 July 1994, *M. Fishbein 1804, S. McMahon, G. Ferguson, R. Felger, M. Wilson* (ARIZ), 19 Aug. 1994, *M. Wilson s.n.* (ARIZ); Arroyo Durazno at La Batería road crossing, 28°17′30″N, 108°20′W, 1730 m, fir-alder riparian forest, 28 June 1986, *G. Ferguson s.n.* (ARIZ, MO); near river in shade of oaks and pines, 27 July 1988, *P. Jenkins s.n.* (ARIZ); Arroyo Durazno, approx. 2 km upstream from La Batería road crossing, 28°17′N, 108°20′W, 1730 m, riparian forest, 7 July 1994, *M. Fishbein 1826, S. McMahon, G. Ferguson, R. Felger, M. Wilson* (ARIZ, MO); Lagotera, 1525–1825 m, 21 July 1965, *C. W. Pennington, 93* (TEX). **Durango:** Coyotes Hacienda, 63 road mi. W-SW of Cd. Durango, 2400–2500 m, open meadows in pine forests, 26 July 1950, *J. H. Maysilles, 7434* (MICH, MO), 16 July 1955, *J. H. Maysilles, 7852, 7860A* (MICH), 10 Aug. 1955, *J. H. Maysilles, 8477* (MICH); just SW of Coyotes Hacienda, slight NE-facing slope, edges of pine woods, 25 Aug. 1980, *M. J. Warnock 2156, S. McCormick, J. Norris* (TEX 2 sheets); 10–12 mi. W of La Ciudad (38–40 mi. W of El Salto); Mazatlán–Durango Rd, 2525 m, steep, moist canyon slope in pine-oak forest, 15 June 1951, *H. S. Gentry & C. L. Gilly, 10615* (ARIZ, MICH); 5.5 mi. E of El Salto, about 55 mi. SW of Durango, open pine-oak woods, 12 Aug. 1957, *U. T. Waterfall 13654, C. S. Wallis* (MO); 6.0 mi. NE of El

Salto, along Hwy. 40, 2300 m, pine-oak forest, 10 Aug. 1994, *S. P. Lynch 14175* (LSUS); hill overlooking town of Llano Grande, 32 mi. W of Durango, on sandy loam, 22 July 1975, *D. LeDoux & Dunn 1947* (ENCB, LL, MO, NY); Mpio. El Salto, "El Capulin," al 4 km noroeste de El Pueblo de 1010, bosque pino-encino, suelo negro forestal, 28 jun. 1982, *P. Tenorio L. 716, C. Romero de T.* (MEXU); 2 km al oeste de Revolcaderos, Carr. Mazatlán–Durango, 2100 m, cañadas escarpadas, bosque mesofilo de montaña, 26 jul. 1989, *A. Vázquez 4905, R. Alvarez* (IEB, LSUS, WIS); Mpio. Tepehuanes, Cerro Boludo, Sierra de la Candela, 20 km al este de Tepehuanes, 1700 m, 21 jul. 1982, *R. Hernández M. 8111, et al.* (MEXU, TEX); 18 km al noroeste de Tepehuanes, bosque pino-encino, suelo negro forestal, 21 jul. 1982, *P. Tenorio L. 1150, C. Romero de T.* (ENCB 2 sheets, MEXU, MO); 9 km al este de Tabahueto, camino a Tepehuanes, ecotonía de selva baja caducifolia y bosque de pino-encino, alterado, suelo pedregoso, 31 ago. 1983, *R. Torres C. 3586, P. Tenorio L., E. Torrecillas* (MEXU, MO 3 sheets); Mpio. Tayoltita, El Pino, 20 km de el entronque a Sapioris con la Brecha Coyotes-San Miguel de Cruces, 24°31′N, 105°49′W, 1860 m, ecotonía bosque de pino-matorral espinoso, 8 jul. 1984, *P. Tenorio L. 6319, C. Romero de T., T. P. Ramamoorthy* (MEXU, MO); Mpio. Canelas, predio particular Las Cebollitas, 1 ago. 1990, *O. Bravo B. 1076* (IEB). **Guanajuato:** Mpio. Atarjea, Cucillos, 2300 m, ladera de cerro, vegetación boscosa, 14 jul. 1990, *E. Ventura & E. López 8285* (IEB). **Sonora:** Mpio. Yécora, El Divisadero (El Bordo), 1 km SE of El Llano on road to Bermudez, Mesa del Campanero, 28°19′41″N, 109°02′38″W, 2100 m, pine-oak forest, 14 July 1997, *T. R. Van Devender 97-647, A. L. Reina, R. L. Belsey, D. Larson, M. J. Martínez C., P. Larson, A. Búrquez M., M. Quintana* (ARIZ).

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Validation of the Name *Cephalotaxus latifolia* (Cephalotaxaceae), a Species from Southeast China

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ABSTRACT. The name *Cephalotaxus latifolia* (W. C. Cheng & L. K. Fu) L. K. Fu is an invalid combination because it was based on *C. sinensis* (Rehder & E. H. Wilson) H. L. Li var. *latifolia* W. C. Cheng & L. K. Fu, which is itself invalid because two specimens (male and female) were indicated as types in the protologue. The name is here validated at the rank of species, with the female specimen as the holotype.

Cephalotaxus latifolia W. C. Cheng & L. K. Fu ex L. K. Fu & R. R. Mill, sp. nov. TYPE: China. Sichuan: Nanchuan County, Jinfe Mountain, 1760 m (female), *X. Q. Chen & K. Y. Liang 2463* (holotype, PE).

A *Cephalataxo sinensi* (Rehder & E. H. Wilson) H. L. Li ramulis robustis et foliis latioribus, apice abrupte mucronatis, margine recurvatis recedit. A *C. harringtonii* (Knight ex K. Koch) J. Forbes foliis saepissime brevioribus (16–30 mm longis, non 25–50 mm) et ratione longitudinis latitudini minore (5–7 : 1, non 10–15 : 1) basi cuneata (non truncata vel obtusa) et a speciminibus typicis illius speciei apice folii abrupte mucronato mucrone 0.2–0.4 mm longo (non in cuspidem 0.5–1 mm gradatim angustato), zonis stomatiferis etiam paulo angustioribus (0.8–1 mm latis, non 1.1–1.3 mm) recedit.

Shrubs or small trees to 5 m; bark grayish brown; branchlets stout. Branchlets oblong in outline, plane, 5.5–9 × 4–5 cm. Leaves borne at (60°–)65°–80°(–85°) to branchlet axis, sessile but decurrent for whole length of internode; blade dark olive green abaxially, linear, ± straight, 1.6–3 cm × 2.8–4(–6) mm, thick and leathery, midvein raised abaxially and bordered on each side by a paler, longitudinal channel, strongly raised adaxially, 0.25–0.5 mm wide, stomatal bands white, 0.8–1 mm wide, of 11–15 rows of stomata, ca. 2–3× as wide as midvein, marginal bands green, ca. 0.3 mm wide, base cuneate, slightly asymmetric, margin flat (slightly revolute when dry), apex abruptly mucronate (mucro 0.2–0.4 mm). Pollen cone capitula axillary on adaxial side of branchlet axis; peduncle 1.5–2.5 mm, scaly; bracts ca. 9, ovate, in 4 rows, apical bracts ca. 0.7 × 0.3 mm, apex mucronate. Seed cones borne 2–6 together; peduncle 2–4 mm, scaly. Seed obovoid, 1.8–2 cm, apex with small mucro at center. Pollination May.

This species is endemic to China, occurring in thickets in mountainous areas from 900 to 2400 m in Fujian, Guangdong, Guangxi, Guizhou, Hubei, Jiangxi, and Sichuan provinces.

Cephalotaxus latifolia was originally described as *C. sinensis* var. *latifolia* by W. C. Cheng and L. K. Fu (in Cheng et al., 1975: 86). However, that name is invalid under the *Tokyo Code* (Arts. 8.1, 37.1) because two types (a male collection, *J. H. Xiong & Z. L. Zhou 90227*, and a female collection, *X. Q. Chen & K. Y. Liang 2463*) were designated. The name was later raised to the rank of species by L. K. Fu (Fu, 1984: 280), but no validation was effected at that time either. The female collection is here designated as the type specimen.

Cephalotaxus latifolia is more similar to *C. harringtonii* (Knight ex J. Forbes) K. Koch ["*harringtonia*"] (= *C. drupacea* Siebold & Zuccarini), from Japan and Korea, than to *C. sinensis*. *Cephalotaxus latifolia* has leaves shorter (16–30 mm), with a smaller length : width ratio (5–7 : 1), stomatal bands slightly narrower (0.8–1 mm wide), and apex abruptly mucronate, with mucro 0.2–0.4 mm. *Cephalotaxus harringtonii* has leaves longer (25–50 mm), with a larger length : width ratio (10–15 : 1), stomatal bands slightly wider (1.1–1.3 mm), and

apex gradually narrowed into a relatively long cusp 0.5–1 mm (as in *C. sinensis*). *Cephalotaxus harringtonii* has often been recorded from China (e.g., by Hu, 1964: 25–26), but apparently always as a misidentification of either *C. latifolia* or *C. sinensis*.

Cephalotaxus sinensis has relatively longer leaves (7–10× as long as wide vs. 5–7× as long as wide in *C. latifolia*), which are gradually acuminate into a cusp that is 0.5–1 mm long. In *C. latifolia* the leaf apex ends abruptly in a short mucro only 0.2–0.4 mm long. In *C. latifolia* the pollen cone capitula are borne on scaly (bracteate) peduncles; in *C. sinensis* these are naked.

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Validation of an Invalidly Described Species of *Gnetum* (Gnetaceae) from Hainan Island, China

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ABSTRACT. *Gnetum hainanense*, previously invalidly described, is validated.

A nomenclatural problem was noticed during work on the Gnetaceae for volume 4 of the *Flora of China*. The original description of *Gnetum hainanense* C. Y. Cheng (Cheng et al., 1975) is invalid because two types (a male collection, *McClure 20084*, and a fertile collection, *Tsang & Fung 554*) were designated. It should be noted that the diagnosis given in the original publication is of questionable validity, as it gave no direct information on the new species but only indicated how another, known, species, *Gnetum parvifolium* (Warburg) Chun, differed from it. The species is well defined and moderately common and needs to be validated. The fertile collection is here selected as the type collection.

Gnetum cleistostachyum C. Y. Cheng was described in the same paper as *G. hainanense*, again with male and female types, and thus this name is also invalid. It was based on two collections at early anthesis. We have seen very little material at a comparable stage of development. What we have seen suggests that the urceolate involucral collars used to characterize *G. cleistostachyum* might be a developmental stage that occurs more widely in the genus, and thus are of questionable taxonomic value. When this is coupled with the absence of seeds, which provide the most reliable diagnostic characters for the group, we prefer not to take up this name. Similarly, we do not intend to recognize any infraspecific taxa within *Gnetum pendulum*. Thus, we are not validating *Gnetum pendulum* f. *intermedium*, also described with male and female types. The question of the validity of an essentially negative diagnosis also applies to *Gnetum pendulum*: again, the diagnosis gave no information on the new species, stating only how *G. oblongum* Markgraf differed from it. However, because all other parts of the protologue are valid and a reasonable illustration is provided, we regard that name as valid.

Gnetum hainanense C. Y. Cheng ex Fu Li-kuo, Yu Yong-fu & M. G. Gilbert, sp. nov. TYPE: China. Hainan Island: Hung Mo Shan, Lai [Loi] area, 22 July 1929 (fr), *Tsang & Fung 554* (holotype, PE 100207; isotypes A, K, PE 1188347). Figures 1, 2.

Species *Gneto lofuense* C. Y. Cheng affinis, sed foliis nervatis lateralibus utroque latere 6–8 (non 9–11), spicibus maribus longioribus, involucris 12–20 (non 9–11), seminibus in sicco laevibus vel obscure reticulatis (non grosse reticulatis), minoribus ((1.5–)1.9–2.1(–2.5) × 1.1–1.4(–1.6) cm, non 2.4–2.8 × 1.5–1.6 cm); a *Gneto parvifolio* (Warburg) Chun foliis maioribus (10–15(–30) × 3–7.5 cm, non 2.5–10(–13) × 1.5–5 cm), spicibus maribus brevioribus, involucris 12–20 (non 5–10(–12)), pilis intrainvolucralibus dense conspicuis (non paucis brevissimis), seminibus in sicco late ellipsoideis non striatis (non fusiformibus longitudine striatis) manifeste differt.

Vines, slender and fragile, glabrous except within the fertile spikes. Petiole 8–12 mm; leaf blade oblong-elliptic or oblong-ovate, 10–15(–30) × 3–7.5 cm, leathery, glossy; lateral veins 6–8 each side. Male inflorescences simple or cymosely once-branched. Male spike 15–30 × 3–4 mm; involucres 12–20; each subtending (40–)60–80(–90) male "flowers" in several ranks plus an uppermost whorl of 15–20(–30) sterile female "flowers"; basal hairs between the "flowers" very numerous and forming a dense brown cushion. Female inflorescence axillary on old branches, cymosely once-branched, 10–15 cm long when fertile. Female spike with 10–20 involucres, rachis thick; each node with 8 or 9 female "flowers." Seed cylindric to broadly ellipsoid, red, outer integument smooth to ± reticulately wrinkled when dry, (1.5–)1.9–2.1(–2.5) × 1.1–1.4(–1.6) cm, sessile or nearly so; apex acute or

Figure 1. Isotype (*Tsang & Fung 554*) of *Gnetum hainanense* C. Y. Cheng ex Fu Li-kuo, Yu Yong-fu & M. G. Gilbert (erroneously written as Yu et al. in photograph).

Figure 2. Detached seed of *Gnetum hainanense*, taken from the packet attached to the isotype sheet (scale in millimeters).

with a small pointed umbo in center. Flowering February–July, producing seeds July–December.

Gnetum hainanense is probably most closely related to *G. lofuensis*, which has rather similar reticulately wrinkled seeds; the seeds differ in *G. lofuensis* by being distinctly larger and much more prominently and coarsely wrinkled, perhaps indicating a thicker fleshy layer. *Gnetum parvifolium*, to which *G. hainanense* was originally likened, is clearly differentiated by the much smaller seeds that are finely longitudinally striate when dried and the smaller male spikes with only 8–12 involucral whorls and with few, short hairs between the male "flowers."

Paratypes. CHINA. **Guangxi**: Lar Pan, W of Hoochih, 22 July 1928, *R. C. Ching 6503* (A); Seh-feng, Dar Shan, S of Nanning, 21 Oct. 1928, *R. C. Ching 8093* (A, NAN); Shang-sze Distr. (near Guangdong border), Na Wai Village, Shap Man Taai Shan, June 1934, *W. T. Tsang 23948* (A); Shang-sze Distr., Shap Man Taai Shan, 31 Aug. 1934, *W. T. Tsang 24161* (A, MO). **Hainan**: Dung Ka to Wen Fa Shi, 520 m, 1932, *N. K. Chun & C. L. Tso 43785* (A, B, K); Pak Shik Ling, Ku Tung village (Ching Mai Distr.), 22 July 1933, *Fung H. 20175* (A, BM, E, K, MO, PE); Ch'ang-kiang Distr., Ka Chik Shan, 28 Mar. 1933, Yaichow, 700 m, 1933, *F. C. How 70550* (MO, PE); no locality, 29 Apr. 1933, *F. C. How 70614* (A, PE), *S. K. Lau 1410* (A, BM); Ue Lung Shan (Ch'ang-kiang Distr.), 25 Jan. 1934, *S. K. Lau 3214* (A); Kan-en Distr., Chim Fung Mt., near Fong Ngau Po Village, Jan. 1935, *S. K. Lau 5256* (A, E); Fat Lo Shi, Yai-hsien, Mar. 1935, *S. K. Lau 5775* (A); Yeung Lam shan, Yai-hsien, Mar. 1935, *S. K. Lau 6282* (A, E); Ling-shui (Ling-tui) Distr., Chim Shan, Fan Maan Ts'uen, May 1932, *S. K. Lau 26455* (A); Bak-sa, 29 Apr. 1936, *S. K. Lau* 26549 (A); Loktung, 24 May 1936, *S. K. Lau 26888* (A, KUN); Pak Shik Ling, Ku Tung village (Ching Mai Distr.), 22 July 1933, *C. I. 875 Lei* (B, K, PE); no locality, 23 Feb. 1934, *H. Y. Liang 65151* (E, PE), *McClure 20084* (GH, K, MO, PE); Paak Po Shan, Taam-chau Distr., 1 Sep. 1927, *W. T. Tsang 727* (A, K, PE).

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Notes on the Piperaceae of China

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ABSTRACT. Four new species of *Piper* are described from China: *P. dolichostachyum*, *P. tsengianum*, *P. wangii*, and *P. yui*; one new combination is made: *Piper boehmeriifolium* var. *glabricaule*; a new name, *Piper cathayanum*, is proposed for a later homonym; the identities of *Piper arboricola* and *P. philippinum* are discussed; and new synonyms and lectotypes are proposed for various other species of *Peperomia* and *Piper*.

The following notes are a precursor to the account of the Piperaceae to be published in volume 4 of the *Flora of China*. The Asian members of this family have been largely ignored by European taxonomists, and our studies have shown the need for a significant number of changes from the first floristic account of the family within China (Tseng in Chen et al., 1982). This account was produced without access to most of the types, or even published assessments of their identities, or to very much material from neighboring countries.

Peperomia blanda (Jacquin) Kunth, in HBK, Nov. Gen. Sp. 1: 67. 1816. *Piper blandum* Jacquin, Collectanea 3: 211. 1789. TYPE: Jacquin, Ic. Pl. Rar. 2, t. 218.

Peperomia arabica Decaisne ex Miquel, Syst. piperac. 1: 121. 1843. TYPE: Yemen. *P. A. Botta s.n.* (lectotype, here designated, P). Rejected syntype: South Africa. Cape of Good Hope to Port Natal, *Drége s.n.* (G).

Peperomia dindygulensis Miquel, Syst. piperac. 1: 122. 1843. TYPE: India. Habitat in rupibus Prov. Dindygul, *Wight* in *N. Wallich 6663B* (lectotype, here designated, K-WALL; isolectotype, P).

Peperomia esquirolii H. Léveillé, Repert. Spec. Nov. Regni Veg. 10: 149. 1912. Syn. nov. TYPE: China. Guizhou ("Kouy Tchéou"): 18 Mar. 1910, *Esquirol 710* (holotype, E; isotype, K).

Peperomia formosana C. DC., Annuaire Conserv. Jard. Bot. Genève 21: 223. 1920. Syn. nov. TYPE: Taiwan: Kelnag Samtianneapass, *Warburg 9338* (holotype, B).

Peperomia japonica Makino, Bot. Mag. (Tokyo) 15: 145. 1901. Syn. nov. SYNTYPES: Japan. Loochoo, 1876, *Coll. Imp. Mus. s.n.* (in hb. Makino) & *H. Kuroiwa s.n.* (in hb. Makino); Okinawa, Nakizin, Mar. 1887, *S. Tashiro s.n.*; Prov. Tosa in Isl. Shikoku: Isl. Heshima, *K. Naganuma s.n.* & 17 June 1887, *T. Makino s.n.* & *Y. Yoshinaga s.n.* (in hb. Makino); Prov. Musashi: Tokyo, Bot. Gard. Koishikawa, cult. from Amami-Oshima, Nov. 1901, *Uchiyama* in *Makino s.n.* (all TI not seen).

Peperomia laticaulis C. DC., Annuaire Conserv. Jard. Bot. Genève 21: 223. 1920. Syn. nov. TYPE: Taiwan: in rupibus montium Kushaka, *Faurie 481* (lectotype, here designated, G-DC; isolectotypes, B, BM, P). Rejected syntypes: Taiwan: Urai, *Faurie 626* (B, BM, P).

A decision has been made to use a rather wide species concept for this pantropical *Peperomia blanda* complex. The variation in stature, leaf shape, coloring, and details of inflorescence morphology are considerable, but we believe that there are not sufficient discontinuities to justify the recognition of distinct taxa, at least in mainland Asia. Material from Japan is very uniform but not distinguishable from some of the collections from the mainland, and there is not a good case for keeping *Peperomia japonica* as a distinct species. The position within Taiwan is more perplexing. There are two distinct forms on the island: a very robust plant without any red pigmentation corresponding to *Peperomia japonica* and including *P. laticaulis*, and a much more delicate plant with red stems and undersides of the leaves and a distinctive epidermis, recently described as *P. sui* (Lin & Lu, 1995). However, the dividing line between these and the mainland plants is not clear, and for now we prefer to include everything within the one taxon. This does not do justice to the Taiwan plants, which taken in isolation would have to be treated as two distinct species. None of the syntypes of *Peperomia japonica* have been seen, but material from Japan proper is very uniform and all belongs to the one taxon of *Peperomia*. There can be no reasonable doubt as to the identity of *P. japonica*.

The opportunity has been taken to designate lectotypes for those taxa for which we have seen syntype material. In the case of *Peperomia arabica*, the specimen from Arabia (Yemen) is clearly in accord with the protologue and, in view of the specific epithet, it seems logical to select this as lectotype in preference to Miquel's other syntype from South Africa. The original material of *P. dindygulensis* in the Wallich herbarium is quite variable. Again, we have chosen a collection clearly associated with the locality from which the taxon was named and one representing one of the more clearly defined forms within the species (drying a rather pale green and with many terminal and subterminal inflorescences). There are two cited syntypes of *P. laticaulis*, *Faurie 481* and *Faurie 626*. These syntypes should both be in Geneva, but *Faurie 626* could not be located there and thus we feel obliged to select *Faurie 481* as the lectotype. Unfortunately, duplicates seen in B, BM, and P show *Faurie 626* to have better developed inflorescences.

Peperomia heyneana Miquel, Syst. piperac. 1: 123. 1843. TYPE: Nepal. Kandrang Garhi, near Kathmandu ["Chandaghiry"], Feb. 1821, *N. Wallich 6663C* (holotype, K-WALL).

Peperomia duclouxii C. DC., Notul. Syst. (Paris) 3: 41. 1914. Syn. nov. TYPE: China. Yunnan: Hay-y, près Lou-Lo, *Ducloux 4760* (holotype, P).

The characters used to distinguish *Peperomia duclouxii* from *P. heyneana* are quantitative, and similar plants have been seen from throughout the range of that species. Moreover, there does not seem to be any discontinuity between the two taxa, and we feel confident that *P. duclouxii* was based on stunted material of *P. heyneana*.

Piper boehmeriifolium (Miquel) C. DC., in A. DC., Prodr. 16: 348. 1868. *Chavica boehmeriifolia* Miquel, Syst. piperac. 1: 265. 1843. TYPE: Bangladesh. Sylhet ["Sillet" or "Silhet"], *N. Wallich 6654A* (holotype, K; isotype, K-WALL).

Piper boehmeriifolium var. **boehmeriifolium**

Piper boehmeriifolium var. *tonkinense* C. DC., in Lecomte, Fl. Indo-Chine 5: 81. 1910. Syn. nov. TYPE: Vietnam. Vallée de Lankok (Mont-Bavi), dans les bois, 9 Mar. 1888, *Balansa 3628* (holotype, P).

Piper spirei C. DC., in Lecomte, Fl. Indo-Chine 5: 87. 1910. Syn. nov. TYPE: Laos. Phon thane, *Spire 258* (holotype, P; isotype, P).

Piper spirei var. *pilosius* C. DC., in Lecomte, Fl. Indo-Chine 5: 88. 1910. Syn. nov. TYPE: Cambodia. Frequens in montibus Krewanh ("Krewwaoh" on holotype), June 1870, *Pierre 4817* (holotype, P; isotypes, P).

Piper terminaliflorum Y. C. Tseng, Acta Phytotax. Sin. 17: 30. 1979. Syn. nov. TYPE: China. Yunnan: Fengqing, 2200 m, 24 June 1938, *T. T. Yü 16454* (holotype, PE; isotypes, A, E).

Piper boehmeriifolium var. **glabricaule** (C. DC.) M. G. Gilbert & N. H. Xia, comb. et stat. nov. Basionym: *Piper glabricaule* C. DC., Notizbl. Königl. Bot. Gart. Berlin-Dahlem 6: 477. 1917. TYPE: China. Yunnan: Mengzi Xian, Mengzi ["Möngtse"] In silvis montium meridionali-orientialum, *A. Henry 9482A* (holotype, B; isotypes, A, K).

Piper boehmeriifolium is the most commonly collected erect species of *Piper* in China and Indochina. There is considerable variation in leaf width; associated with this is variation in the number of leaf veins, peduncle length, and bract diameter, the principal characters used to distinguish *P. boehmeriifolium* var. *tonkinense* from *P. glabricaule*. We are unable to define any discontinuity between *P. boehmeriifolium* s. str. and variety *tonkinense* that should be included within the species. Male plants appear to have effectively determinate growth, with the uppermost leaves very poorly developed so as to leave the inflorescences in a terminal position. Y. C. Tseng treated such plants as a distinct species, *P. terminaliflorum*. However, there are a few male plants from throughout the distribution of *P. boehmeriifolium* that resemble the type of *P. terminaliflorum*, and we believe that this species is also better included within *P. boehmeriifolium* s. str. The small fruits of *P. glabricaule* are more distinctive, but again the variation is almost continuous. We therefore prefer to treat *P. glabricaule* as a variety of *P. boehmeriifolium* rather than as a full species.

The type collections of *Piper spirei* and *P. spirei* var. *pilosius* are not distinguishable from *P. boehmeriifolium*. However, the Chinese collection that was the basis of the record of *Piper spirei* in the *Flora Reipublicae Popularis Sinicae* account (Tseng in Chen et al., 1982) has not been matched with any other species and is described here as the new species *P. dolichostachyum*.

Piper cathayanum M. G. Gilbert & N. H. Xia, nom. nov. Basionym: *Chavica sinensis* Champion ex Bentham, Hooker's J. Bot. Kew Gard. Misc. 6: 116. 1854. *Piper sinense* (Champion ex Bentham) C. DC., in A. DC., Prodr. 16: 361. 1868, nom. illegit. Blocking name: *Piper chinense* Miquel, London J. Bot. 4: 439. 1845. TYPE: Hong Kong: *Champion 491* (holotype, K, ex herb. Bentham; isotype, K, ex herb. Hooker).

It is with distinct regret that we designate a new name for *Piper sinense*. This is a much better known species than that with the blocking name, *P. chinense*, which is certainly extremely rare or even extinct, known to us only from the type. Unfortunately the ICBN, Article 53.3, Example 8 (Greuter et al., 1994), is quite clear that "chinense" and "sinense" must be treated as homonyms; thus the later homonym must be given a new name.

K has two sheets of *Champion 491*, but the one from Bentham's personal herbarium must be presumed to be the holotype, while the slightly better sheet from Hooker's personal herbarium is an isotype.

Piper dolichostachyum M. G. Gilbert & N. H. Xia, sp. nov. TYPE: China. Yunnan: Jingping, 16 Apr. 1956, *Sino-Soviet Botanical Exped. 67* (holotype, SCBI; isotype, KUN).

A *Piper boehmeriifolio*, nervis paginis foliis abaxillaribus dense rufipilosis, non glabris vel sparse pallidipuberulis, infructescentibus femineis longissimis (27–30 cm, non 6–12 cm), manifeste differt.

Erect, shrubby herb; most parts with reddish brown hairs. Stems 3–4 mm thick, furrowed when dry, glabrescent. Petiole 5–13 mm, densely pubescent, prophyll to 3 cm, glabrous; leaf blade elliptic-lanceolate to obovate, strongly asymmetrical, to 14–25 × 6–11 cm, thinly papery, base strongly obliquely cordate, basal lobes overlapping, bilateral difference to 3 mm, apex long acuminate, veins 8–10, 3 on the narrow side, up to 7 on broad side, apical pair arising 2–6 cm above base, alternate, nearly reaching leaf apex, next pair often also above base, reticulate veins lax, transversely oblong, slightly raised abaxially, without evident glands, abaxially densely brown-pubescent, almost tomentose on veins, adaxially sparsely minutely scabrid. Plants dioecious. Spikes leaf-opposed. Male spike not seen. Female spikes 27–30 × 0.6–0.7 cm in fruit, peduncle 4–4.5 cm, glabrous; rachis pubescent; bracts orbicular, peltate, margin pale when dried, 1.5–1.7 mm diam. Ovary ± cylindrical; stigmas 3 or 4, reflexed, very short and inconspicuous. Drupes densely packed, prismatic-cylindrical, ca. 2 × 1.5 mm.

This material was first identified as *Piper spirei* C. DC. (Tseng in Chen et al., 1982), but examination of the holotype of that name has shown it to be inseparable from *P. boehmeriifolium* and has revealed that this Chinese specimen was without a name. One of the more distinctive features is the extremely long infructescence, and it has been named accordingly (Greek: *dolichos* = long, *stachys* = spike, as in the inflorescence of wheat). The other distinctive feature is the indumentum, which is quite dense and reddish brown, in contrast to *P. boehmeriifolium*, which is glabrous or only sparsely and inconspicuously puberulent.

Piper hongkongense C. DC., in A. DC., Prodr. 16: 347. 1868. TYPE: Hong Kong: *Seemann* (holotype, G-DC not found).

Chavica puberula Bentham, Fl. Hongk.: 335. 1861. Syn. nov. *Piper puberulum* (Bentham) Maximowicz, Bull. Acad. Imp. Sci. Saint-Pétersbourg, sér. 3, 31: 94. 1887, nom. illegit. Blocking name: *P. puberulum* (Bentham) Seemann, Fl. Vit. 268, t. 75. 1868, based on *Macropiper puberulum* Bentham, London J. Bot. 2: 235. 1843. TYPE: Hong Kong: *Hance 10159* (holotype, BM).

The hairy species of *Piper* in southeastern China have been subjected to more than their fair share of nomenclatural problems. One of the more widely used names is *P. puberulum* (Bentham) Maximowicz, which is based on material collected on Hong Kong Island. Unfortunately, this is a later homonym of *P. puberulum* (Bentham) Seemann, which is based on a very different species from Fiji. Thus a name regarded as a synonym in all works subsequent to publication must be resurrected. A probable factor in the confusion between the two homonyms must have been the fact that both were based on taxa described by Bentham, the Fijian species in *Macropiper* and the Chinese species in *Chavica*. The next available name is *P. hongkongense*, which has been consistently ignored (Bretschneider, 1898) or treated as a synonym of *P. puberulum* (Bentham) Maximowicz (Hemsley, 1891) ever since it was published. There is a problem with the typification of *P. hongkongense* in that the protologue cited only one element, "Hongkong (Seemann! in h. DC.)," which was not found in the De Candolle herbarium in Geneva. Hemsley (1891) cited a collection by Seemann from Hong Kong under *P. puberulum* (Bentham) Maximowicz apparently in Kew, but no material attributed to Seemann was found there either. If another search of the Geneva herbarium fails to locate this material it is suggested that *Hance 10159*, the holotype of *Chavica puberula*, be designated the neotype of *P. hongkongense*.

The protologue of *Chavica puberula* gave no details of the type beyond "Hongkong, Hance" but there is only one collection in K and BM, *Hance 10159* in BM, that has been annotated by Bentham and it is assumed that this is the holotype.

The species varies from very densely hairy to quite thinly hairy. Material with a thinner indu-

mentum has often been regarded as conspecific with material from Taiwan and placed within "*Piper arboricola.*" The Taiwan material is here regarded as belonging to an endemic taxon, *P. sintenense* (q.v.), while the mainland material seems to be better regarded as belonging to a single variable species.

Piper kadsura (Choisy) Ohwi, Acta Phytotax. Geobot. 3: 81. 1934. *Ipomoea kadsura* Choisy, Mém. Soc. Phys. Genève 6: 475. 1833. TYPE: Japan. "Iaponicae: Karami Kadfura, it. Saifin." (holotype, UPS-THUNB).

Piper arboricola C. DC., Annuaire Conserv. Jard. Bot. Genève 21: 221. 1920. Syn. nov. TYPE: Taiwan: in arboribus Ke-Lung, 13 May 1903, *Faurie 480* (lectotype, here designated, G; isolectotypes, BM, P(2 sheets)).

Until recently the name *Piper arboricola* had been applied almost entirely to material of what is here named as *P. sintenense.* Examination of duplicates of the syntypes of *P. arboricola* in BM and P shows that this represents a rather broad-leaved form of *Piper kadsura* and that *P. arboricola* must be treated as a synonym of that species. Japanese authors have spelled the epithet as "*kadzura,*" presumably in accordance with current transliteration of the vernacular name upon which the epithet is based. This is not in accordance with the spelling used in the protologue and associated literature, which should be retained. *Faurie 480* is selected as the lectotype of *P. arboricola* in preference to *Faurie 479,* because although the two collections are very similar in quality there seem to be more sheets of *Faurie 480* available. Records of this species from Fujian and Zhejiang are based on material that seems better regarded as a form of *Piper wallichii.*

Piper kwashoense Hayata, J. Coll. Sci. Imp. Univ. Tokyo 30: 235. 1911. TYPE: Taiwan: Kwashoto, 1907, *Kawakami & Kobayashi 475* (holotype, "*Tokyo Univ.*").

This taxon has been named as *Piper philippinum* Miquel, following the account of Philippine Piperaceae by Quisumbing (1930: 110). However Miquel's (1843) protologue clearly excludes the taxon described by Quisumbing, as it refers to a plant with 5-veined leaves, lax female inflorescences 10–12 cm long, and ovoid fruits 4–5 mm long, apparently free from the rachis. Quisumbing used the name for a plant with 7-veined leaves, female spikes 3–9 cm long, and relatively dense and subglobose fruit, 2–3 mm in diameter, partly connate to the rachis. The mistake seems to have come from Miquel, who based the protologue proper on a female plant, "*Cuming* in herb. de Lessert 1642," and then added a note that another collection, *Cuming 912,* might be the male of the same species though it did have a number of differences. This latter collection is much more widely distributed, and *P. philippinum* has been interpreted as if *Cuming 912* were the type and the description in the protologue ignored.

Piper macropodum C. DC., Bull. Herb. Boissier, sér. 2, 4: 1026. 1904. TYPE: China. Yunnan: Simao Xian, Simao ["Szemao"], 1370 m, *A. Henry 12210D* (holotype, Z not seen; isotype, K).

Piper szemaoënse C. DC., Notizbl. Königl. Bot. Gart. Berlin-Dahlem 6: 481. 1917. Syn. nov. TYPE: China. Yunnan: Simao Xian, Simao ["Szemao"], 1370 m, *A. Henry 12210B* (lectotype, here designated, B; isolectotypes, A, E, K, MO).

Piper szemaoënse was separated from the completely glabrous *P. macropodum* by the presence of an indumentum. The two taxa are sympatric and, from the numbering used, were regarded by the collector as just one species. All other variation is continuous, and we have no hesitation in maintaining only one taxon. Two collections were listed in the protologue of *P. szemaoënse, Henry 12210A* and *12210B* (as *Henry 1210A* and *1210B*). The latter collection is selected as lectotype because it is female, and thus taxonomically more informative, and also because it seems to be slightly more widely distributed.

Piper pedicellatum C. DC., J. Bot. 4: 164. 1866. TYPE: Bangladesh ["Bengalia orient."]. *Griffith 4404* (lectotype, here designated, K not seen; isolectotype, P).

Piper curtipedunculum C. DC., Notizbl. Königl. Bot. Gart. Berlin-Dahlem 6: 481. 1917. Syn. nov. TYPE: China. Yunnan: Mengzi Xian, Mengzi ["Mongtse"], *A. Henry 10438* (holotype, B; isotypes, A, E, K).

The protologue of *Piper pedicellatum* lists three elements, *Hooker & Thomson s.n.* from Sikkim, in Geneva ("Herb. Cand."), and two collections by Griffith, *4404* and *4418,* from "Bengalia orient.," now Bangladesh, in Kew. The Geneva sheet of the Hooker and Thomson collection was not located during a visit to Geneva and, because most exsiccatae of these collectors were distributed with very incomplete label data, there is often doubt as to which sheets belong to the same collection. Thus, it does not seem advisable to select this collection

as the type. *Griffith 4418* is of female material, and De Candolle indicated some doubts (probably unjustified) about the identity of this collection in a later account of this species (C. De Candolle, 1869: 350) so this syntype also seems best rejected. *Griffith 4404* is of male material, and as the epithet alludes to the distinctively long-stalked male bracts, it seems best to select this as the lectotype.

The minor quantitative differences in leaf shape, peduncle length, and bract size used to separate *Piper curtipedunculum* from *P. pedicellatum* have proved too ill-defined to justify the maintenance of two taxa, especially when material from the full range is considered.

Piper pubicatulum C. DC., in Lecomte, Fl. Indo-Chine 5: 74. 1910. TYPE: Vietnam. "In nemore Vän Xà, 4 May 1886, *Bon 3139bis*" (holotype, P).

There is some doubt as to the identity of the type of this species. The above specimen is the only sheet so named found in the Paris herbarium. It was determined by C. De Candolle. The protologue gives the type as *Bon s.n.* from "Tonkin, environs de Ninh Binh," but no such material was seen and we have assumed that *Bon 3139bis* must be the collection upon which the species was based. The material has 5-veined leaves with more or less symmetrical, cuneate bases, glabrous bracts, and very densely packed, globose fruit ca. 1 mm in diameter. The protologue describes the leaves as 5-veined with slightly oblique bases and glabrous bracts. In distinct contrast, Chinese material so named has 7–9-veined leaves with distinctly oblique bases, rounded to almost cordate on one side, and hairy bracts. It seems certain that the Chinese material is not correctly named. Because it has not been possible to match it with any other species, it is described below as a new species, *Piper wangii.*

Piper rhytidocarpum J. D. Hooker, Fl. Brit. India 5: 92. 1886. TYPE: Bangladesh. Chittagong, 22 Sep. 1850, *Hooker & Thomson s.n.* (lectotype, here designated, K; isolectotype, K).

Piper madidum Y. C. Tseng, Acta Phytotax. Sin. 24(5): 382, fig. 1. 1986. Syn. nov. TYPE: China. Xizang: Medog, Beibeng, 850 m, 9 Apr. 1983, *B. S. Li & S. Z. Cheng 3990* (holotype, PE not seen; isotypes, (2, not annotated) PE).

Rejected syntypes. BANGLADESH ("East Bengal"). *Griffith 4423* (K); Chittagong, 17 July 1850, *Hooker & Thomson s.n.* (K), *F. de Silva & W. Gomez* in *Wallich 6658B* (K).

The collection designated here as lectotype is annotated by Hooker and is the only collection cited in the protologue with apparently mature fruit. The material of *Piper madidum* from southeastern Xizang is a good match in all features, including the peculiar sessile scales on the undersides of the leaves, though the fruits are too immature to show the granulose surface of the fruits upon which the specific epithet was based. No material annotated by the author was seen, but two unnamed sheets matching in all details and fitting the description have been seen.

Piper sarmentosum Roxburgh, in Hunter, Asiat. Res. 11: 565. 1810. *Chavica sarmentosa* (Roxburgh) Miquel, Syst. piperac. 1: 242. 1843. TYPE: "cultivated in Calcutta," Roxburgh tab. 1267 (lectotype, here designated, K).

Piper albispicum C. DC., in Lecomte, Fl. Indo-Chine 5: 85. 1910. Syn. nov. TYPE: Vietnam. Tonkin méridional: In sepib. Ninh Bhinh., 4 Nov. 1881, *Bon 982* (holotype, P).

Piper brevicaule C. DC., Annuaire Conserv. Jard. Bot. Genève 2: 272. 1898. Syn. nov. TYPE: Vietnam. Tonkin: village de Tchontiao, a la base du Mont-Bavi, July 1886, *Balansa 3631* (lectotype, here designated, P).

Piper gymnostachyum C. DC., in Lecomte, Fl. Indo-Chine 5: 72. 1910. Syn. nov. TYPE: Cambodia. Phuocthan, *Thorel "T"* (lectotype, here designated, P).

Piper lolot C. DC., Annuaire Conserv. Jard. Bot. Genève 2: 272. 1898. Syn. nov. TYPE: Vietnam. Tonkin, Environs de Quang-yen. Sep. 1885, *Balansa 539* (holotype, P).

Piper pierrei C. DC., in Lecomte, Fl. Indo-Chine 5: 78. 1910. Syn. nov. TYPE: Vietnam. In sylvis ad Baochiang in austro Cochinchine, Sep. 1869, *Pierre 4814* (holotype, P; isotype, P).

Piper saigonense C. DC., in Lecomte, Fl. Indo-Chine 5: 79. 1910. Syn. nov. TYPE: Vietnam. Ad urbem Saigon in austro Cochinchine, Aug. 1872, *Pierre 1142* (holotype, P; isotypes, MO, P).

Piper sarmentosum is a distinctive species, easily recognized by the creeping, more or less terrestrial habit, virtually unmatched among Asiatic *Piper*, combined with the very distinctive leaves, which are usually palmately veined or almost so with a very minute "powdery puberulent" indumentum, and infructescences white at anthesis and with fruits fused to the rachis when mature.

The earliest literature reference to this taxon appears to be by Hunter (1807) who used the provisional name "Piper latifolium" for a sterile plant. In subsequent correspondence with Roxburgh, it was established that this was the same as a species in cultivation in Calcutta and provisionally named by Roxburgh. Hunter published the name and description that Roxburgh had supplied in an appen-

dix to volume 11 of "Asiatick Researches," but this has been largely overlooked; the name is more often given as validated in 1820 in Roxburgh's *Flora Indica*. No Roxburgh herbarium material has been located, but the species was illustrated for Roxburgh (painting 1267) and this makes an adequate lectotype. The leaves are often used as a condiment and also medicinally, and it is likely that it has been spread by humans: many of the records are from around habitation. It was therefore surprising to find that so many collections from Vietnam and Cambodia have been described as distinct species. It seems that C. De Candolle failed to recognize the extremely distinctive habit and based his descriptions on minor variations in leaf size and shape, due largely to variation between the lower leaves and the uppermost leaves associated with the inflorescences, and also variation in size and color of the inflorescence with age.

Two collections annotated as *Piper brevicaule* by C. De Candolle were found in the Paris herbarium: *Balansa 3631* from "Tonkin: village de Tchontiao, a la base du Mont-Bavi" and Godefroy in *Harmand s.n.* from Saigon. The protologue cited two syntypes, *Balansa 3631* with details almost exactly as above, and "Cambodje (*Harmand* in h. Mus. Par. Spec. fructiferum)." In view of the apparent discrepancy between protologue and herbarium specimen, it seems best to designate the Balansa collection as lectotype, especially as De Candolle himself wrote "sp. nov." on the sheet. *Piper gymnostachyum* was based on two collections by Thorel: "T," a male collection from Phuoc-than, Cambodia, and "V," a fruiting collection from Nha-met, Vietnam. The latter collection, particularly the infructescences, has been infested by fungi, making it difficult to see the indumentum, particularly the "naked spikes" alluded to by the epithet. It thus seems preferable to select the better preserved male collection as the lectotype.

Piper sintenense Hatusima, Acta Phytotax. Geobot. 4: 210. 1935. TYPE: Taiwan. Prov. Taihoku, in silvis districtus Kanko, Nov. 1932, *S. Hatusima s.n.*

Piper hispidum Hayata, J. Coll. Sci. Imp. Univ. Tokyo 30: 234. 1911. Not *P. hispidum* Kunth, in HBK, Nov. Gen. Sp. 1: 50. 1816. TYPE: Taiwan: Koshun, Garanbi, 1896, *Y. Tashiro s.n.* (holotype, TAI; [Tokyo, photo] TAI).

Most material of this taxon has been named as *Piper arboricola* (see Tseng in Chen et al., 1982). Examination of type material of *P. arboricola* has shown clearly that it belonged to *P. kadsura* and that the name was incorrectly applied to this species. This taxon is most easily recognized by the membranous leaves, usually drying dark green, and by the coarse curved hairs on the stems. The only available name is *Piper sintenense*.

Piper thomsonii (C. DC.) J. D. Hooker, Fl. Brit. India 5: 87. 1886. *Chavica thomsonii* C. DC., Prodr. 16: 389. 1868. TYPE: India. Khasia Mountains, 20 June 1850, *Hooker & Thomson 18* (holotype, B; isotype, K).

Piper bavinum C. DC., Annuaire Conserv. Jard. Bot. Genève 2: 270. 1898. Syn. nov. TYPE: Vietnam. Mont Bavi, vallée de Lankok, entre Moc-ha et Lang-nuong, *Balansa 3630* (lectotype, here designated, P).

Piper punctulivenum C. DC., in Lecomte, Fl. Indo-Chine 5: 77. 1910. Syn. nov. TYPE: Laos. Luang Prabang, *Thorel s.n.* (lectotype, here designated, P).

Piper punctulivenum var. *parvifolium* C. DC., in Lecomte, Fl. Indo-Chine 5: 77. 1910. Syn. nov. TYPE: Laos. Paklai, *Thorel s.n.* (holotype, P).

This species is very common in southwestern China and can be recognized instantly by the characteristic dark red glands of the leaves; the long-acuminate leaves with pale undersides and short infructescences are also distinctive. *Piper bavinum* has been distinguished primarily by having shorter inflorescences and lacking the very finely powdery pubescent indumentum of *P. thomsonii* s. str., but it is now clear that there is a continuity in variation such that it is not possible to justify treating these two taxa as distinct. *Piper punctulivenum* and its variety are clearly this species with even more prominent leaf glands than in the rather poorly preserved types of *P. bavinum*.

Piper thomsonii has sometimes been included within *Piper sylvaticum* Roxburgh, most notably by Long (1984), but there are discrepancies between the taxon as accepted here and the protologue of Roxburgh's species. Most notably, the protologue mentions the leaves as being "broad-cordate, obtuse, lobes of the base large, equal, circular," which coupled with the mention of stems creeping on the ground is much more suggestive of another one of Roxburgh's species, *Piper sarmentosum*. The type illustration includes an enlargement of a leaf tip that is clearly bluntly acuminate; it must be assumed that the "obtuse" in the protologue does not refer to the leaf apex as a whole, which is shown as being very distinctly acuminate in overall form.

The protologue of *Piper bavinum* cites two collections, *Balansa 3627* and *Balansa 3630*. Neither collection is of very high quality, both being so poorly dried that the usually distinctive dark red glands can only be seen with careful examination. Choice of a lectotype is somewhat arbitrary, but it

could be argued that the specimen citation by C. De Candolle (1910), "Tonkin: mont Bavi, vallée de Lankok, entre Moc-ha et Lang-nuong (*Balansa*)," clearly refers to *Balansa 3630* from exactly that locality. This could be regarded as a move toward lectotypification by the original author and, as the quality of the material is uniform, it is best to confirm this selection as the lectotype. The material of *P. punctulivenum* is of much better quality with nothing to pick between the two syntypes of *P. punctulivenum* s. str., both unnumbered *Thorel* collections, one from Luang Prabang and the other from the same area as the holotype of variety *parvifolium* (Paklai). The collection from Luang Prabang is selected as lectotype on the grounds that it is more likely that there could be significant differences between the material from different localities than between the two collections from the same area (Paklai).

Presumed paratype of P. bavinum. VIETNAM. Forêts du Mont-Bavi, au-dessus de la pagode de Dèin-Touan, 18 Mai 1888, *Balansa 3627* (P).

Piper tsengianum M. G. Gilbert & N. H. Xia, sp. nov. TYPE: China. Yunnan: flanks of Shweli valley, ca. 24°20′N, 98°33′E, 2100–2400 m, May 1925, *Forrest 26411* (holotype, A; isotype, E).

A *Piper flavifloro,* paginis foliis abaxillaribus squamis griseo-albis obtectis, non pallidiviridis nudis, inflorescentibus maribus longissimis griseo-viridis, non flavis, manifeste differt.

Shrubs, climbing, 1.2–2 m, apparently glabrous. Stems pale brown when dry, 2–2.5 mm thick, terete, striated. Prophylls ca. 15 mm; petioles 8–13 mm; leaf blade lanceolate, 8–10.5 × 3.2–4.5 cm, papery, base ± rounded to subcuneate, symmetrical, apex long acuminate; veins 5, apical pair arising 0.5–1.5 cm above base, alternate, other pair basal, reticulations raised adaxially, inconspicuous abaxially, without evident glands, abaxially with dense layer of ?sessile scales. Plants dioecious. Spikes leaf-opposed. Male spikes 7–20 cm, 2–2.5 mm thick; peduncles to 1.8 cm; rachis densely hairy, bracts orbicular, 1.3–1.5 mm wide, peltate, obscurely gland-dotted, subsessile. Stamens 3 or 4, filaments longer than anthers, anthers ovoid, apically confluent. Female spike (only one seen) shorter and thicker than male, ca. 2.5 cm long, 3.3 mm thick; peduncle ca. 2 cm; rachis hairy, bracts similar to those of male, 1–1.2 mm wide. Ovary globose to slightly oblate, slightly wider than bracts, free; stigmas 4, linear-lanceolate, tightly adpressed to ovary. Fruit not seen. Flowering May–June.

We are hesitant to describe collections lacking fruits as a new species, but we believe that these can only be related to *Piper flaviflorum.* The differences from that species are so clearly marked that the two species must be treated as distinct. The exact nature of the covering of the abaxial leaf surfaces is difficult to make out but seems best regarded as a layer of sessile scales.

Paratypes. CHINA. **Yunnan:** Shweli-Salwin divide, ca. 25°45′N, 98°40′E, 2100–2450 m, June 1924, *Forrest 24388* (E, K).

Piper wallichii (Miquel) Handel-Mazzetti, Symb. Sin. 7: 155. 1929. *Chavica wallichii* Miquel, Syst. piperac. 2: 254. 1843. *Piper aurantiacum* Wallich ex C. DC., in A. DC., Prodr. 16: 357. 1868, nom. illegit. (cited *Chavica wallichii* as a synonym). TYPE: Nepal. "In Nepalia," 1821, *N. Wallich 6658A* (lectotype, here designated, K; isolectotypes, A, BM, P).

Piper aurantiacum var. *hupeense* C. DC., Notizbl. Königl. Bot. Gart. Berlin-Dahlem 6: 478. 1917. *Piper wallichii* var. *hupeense* (C. DC.) Handel-Mazzetti, Symb. Sin. 7: 155. 1929. TYPE: China. Hubei: *A. Henry 3893* (lectotype, here designated, B; isolectotypes, GH, K).

Piper emeiense Y. C. Tseng, Acta Phytotax. Sin. 24: 385, fig. 3. 1986. Syn. nov. TYPE: China. Sichuan: Mt. Emei, *C. H. Hsiung* 32838 (holotype, IBSC).

Piper ichangense C. DC., Notizbl. Königl. Bot. Gart. Berlin-Dahlem 6: 480. 1917. TYPE: China. Hubei: Hupeh occidentalis: prope Ichang, Oct., *Wilson 499* "*489*" (holotype, B; isotypes, A, K, P).

Piper martinii C. DC., Notul. Syst. (Paris) 3: 41. 1914. Syn. nov. TYPE: China. Guizhou ("Kouy Tchéou"): environs de San-pin, rocailles au-dessus de la grande grotte, *L. Martin & E. Bodinier 2298* (lectotype, here designated, P; isolectotype, E).

This taxon was first named as "*Piper aurantiacum*" by Wallich in his Catalog, under his number 6658 and including two collections, one from Nepal collected by himself and the other from Sillet, now in Bangladesh, collected by F. de Silva and W. Gomez, but no description was given and that name is invalid. The first valid name was that of Miquel, who cited the original Wallich collections but did not take up Wallich's epithet. The collection from Sillet was subsequently included by Hooker as a syntype of *P. rhytidocarpum,* and thus Wallich's own collection from Nepal is the only sensible choice as lectotype. The protologue of *Piper aurantiacum* var. *hupeense* cited two collections: *Wilson 499* in CAL and *A. Henry 3893* in B. Both are well represented by duplicates in a number of major herbaria, but because it has not been possible to see the cited collection of *Wilson 499,* and another sheet of this collection was made the type of *Piper*

ichangense, it seems advisable to select the Henry collection as lectotype. The type of *P. ichangense* was given as *Wilson "489."* There are rather complete sets of Wilson's collections in A and K, so it was puzzling when it was not possible to locate any *Piper* with this number. The problem was solved by examination of the holotype sheet in B, which has two labels: an original with "*499*" and a second label added in B with "*489*," clearly a copying error. There are two collections of *P. martinii* cited in the protologue, both in Paris and annotated by De Candolle: *Cavalerie 2387* and *Martin & Bodinier 2298*. Other things being equal, we have selected the latter as lectotype in view of the epithet used for the taxon, and because there is a duplicate specimen in Edinburgh; *Cavalerie 2387* seems to be a unicate.

Tseng (in Chen et al., 1982) distinguished *Piper wallichii* and *P. martinii* as follows:

1a. Male spikes ca. 2× as long as leaf blades, peduncles 2.5–3× as long as petioles; petioles of female bracts barely elongated in fruit, sparsely pubescent . . . . . *P. martinii*

1b. Male spikes nearly as long as leaf blades, peduncles nearly as long as petioles; petioles of female bracts elongated to 2 mm in fruit, densely long white pubescent . . . . . *P. wallichii*

The differences in inflorescence dimensions are not well defined and do not justify recognition of distinct taxa. The bract characters sound extremely distinctive, but we have not seen any material that matches the description given for *Piper wallichii*. This includes the types of *P. wallichii* and *P. martinii*, which key out together in the above key and are certainly conspecific.

Piper emeiense was distinguished from *P. wallichii* by the small leaves, which have palmate lateral veins and a very thin indumentum, and by the short peduncles. Other collections seen from near the type locality, Mount Emei, show a transition between juvenile climbing stems with foliage very like that seen in the type collection of *P. emeiense* and flowering stems with adult foliage typical of *P. wallichii*. We believe that there can now be little doubt that *C. H. Hsiung 32838* is material of *P. wallichii* that has flowered in an unusually juvenile stage, directly from the climbing stems without the production of normal flowering stems.

Piper wangii M. G. Gilbert & N. H. Xia, sp. nov. TYPE: China. Yunnan: Jing Hong, Nan-hsien-ho, 800 m, Oct. 1936, *Wang C. W. 79466* (holotype, A; isotypes, KUN, PE).

A *Piper pubicatulo*, foliis (5–)7(–9)-nervis (non 5-nervis) basibus manifeste obliquis (non aequilateris), stipitibus bracteorum pilosis (non glabris), fructibus maioribus (plus quam 1.5 mm, non ca. 1 mm) differt; a *P. boehmeriifolio* et *P. pedicellato*, habitu scandentibus, foliis latioribus (7–12 cm, non (2.5–)4–9.5 cm), inflorescentibus femineis brevioribus (ca. 3 cm, non 6–14 cm) differt.

Climbers, glabrous except for rachis. Stems finely striated, tuberculate. Prophylls ca. as long as petioles; petioles 1–1.5 cm; leaf blade broad-elliptic to ovate, (12.5–)15–21 × 7–12 cm, papery, base obliquely rounded-cuneate, apex acute to acuminate; veins (5–)7(–9), apical pair arising (2–)3–6.5 cm above base, almost reaching leaf apex, 1(or 2) pair(s) basal, reticulate veins conspicuous, densely finely glandular. Plants dioecious. Spikes leaf-opposed. Male spike not seen. Female spikes ca. 3 cm in young fruit; peduncle 1–1.4 cm; bracts peltate, orbicular, stalk pilose, 0.7–1 mm diam., margin not entire, glabrous abaxially. Ovary distinct; stigmas 3 or 4, short, ovate-lanceolate. Unripe drupe subglobose, ca. 1.5 mm diam. Flowering May–June, October.

Material of this species was originally identified as *Piper pubicatulum* C. DC. Examination of the presumed holotype of *P. pubicatulum, Bon 3139 bis*, shows this to be a distinct species, easily distinguished by the 5-veined leaves with symmetrical, cuneate bases, glabrous bracts, and densely packed, globose, fruits ca. 1 mm in diameter. The Chinese material is related to species such as *P. boehmeriifolium* and *P. pedicellatum*, which have similarly shaped and textured leaves, but it is easily recognized by the combination of the climbing habit, broader leaves, and short inflorescences. One sheet (*Wang 76584*) states that the leaves are edible.

Paratypes. CHINA. **Yunnan:** Lan Chang Xian, 1500 m, May 1936, *Wang C. W. 76584* (A, IBSC).

Piper yui M. G. Gilbert & N. H. Xia, sp. nov. TYPE: China. Yunnan: Kiukiang Valley, Chingontum, 1300 m, 25 Sep. 1938, *T. T. Yü 20434* (holotype, A; isotypes, E, PE).

A *Piper nudibaccato*, apicibus foliis rotundatis vel subacutis, non acutis vel acuminatis, et bracteis obovatis ca. 1.5 mm longis, non orbicularis ca. 1 mm diam., differt.

Climbers, woody. Stems dark brown when dry, striated, minutely hispidulous when young. Prophylls ca. as long as petioles; petiole 0.8–1.4 cm, hispidulous; leaf blade elliptic, to 9 × 4.5 cm, papery, drying dark green, base obliquely cordate to ± rounded, one side to 3 mm higher, almost symmetrical in uppermost leaves, apex rounded to broadly acute; veins 5(–7), apical pair arising 0.3–0.8(–1.2) cm above base, others basal, reticulations

slender, raised both sides in dry material, finely glandular, very finely and sparsely puberulent on veins, otherwise glabrous. Plants dioecious. Spikes leaf-opposed. Male spike not seen. Female spikes to 15 cm in fruit; peduncle to 5.3 cm, rachis and undersides of bracts densely brownish hairy; bracts obovate, ca. 1.5 × 1 mm. Ovary ovoid, partly connate to rachis; stigmas 3 or 4, ellipsoidal, reflexed. Drupe (immature) ellipsoid, ca. 6 × 3 mm, slightly rugulose, partly connate to rachis. Young fruit September–October.

The strictly elliptical leaves with rounded apices of this species are immediately distinctive and are not matched by any species from China and Indochina. *Piper hamiltonii* C. DC. is the only species with leaves similar in shape, but this poorly known species from northern India has completely different inflorescences and the similarity is probably due to convergence.

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Licaria caribaea (Lauraceae): A New Species from the Caribbean Lowlands of Costa Rica

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ABSTRACT. A new *Licaria* (Lauraceae) from the Caribbean lowlands of Costa Rica is described and illustrated here.

RESUMEN. Una *Licaria* (Lauraceae) de las tierras bajas del Caribe costarricense se describe y se ilustra en este artículo.

Licaria Aublet (Lauraceae) is a Neotropical genus of trees represented in Costa Rica by at least eight species, some of them very poorly understood (Burger & van der Werff, 1990). It is well characterized by its androecium of three stamens with two thecae each and the deeply cupulate fruiting receptacle with two usually distinct margins on its rim. An additional species from the Caribbean lowlands is described below.

Licaria caribaea Gómez-Laurito & Cascante, sp. nov. TYPE: Costa Rica. Limón: Límite norte del Parque Nacional Tortuguero, Caño Suerte, 9°36′42″N, 83°45′00″W, 0–10 m, 2 set. 1995 (fl, fr), *A. Cascante & A. Ruíz 705* (holotype, CR; isotypes, F, MO, USJ). Figure 1.

Species inflorescentia paniculata usque 32 cm longa, multiflora; stamina 2-locellata, locellis extrorsis, apicalibus; cupula late conica, usque 42 mm longa, longitudinaliter cristata a congeneribus diversa.

Trees 12–15 m tall, 20–30 cm DBH; bark lenticellate; inner bark yellowish, hard; leafy branchlets minutely puberulous, grayish, solid, terete. Leaves alternate; petioles 10–20 mm long, sulcate above, glabrous; leaf blades 18–24 cm long, 8–11 cm broad, ovate-elliptic, tapering to an acuminate apex, obtuse at the base, drying chartaceous and brownish green, glabrous on both surfaces, with 8–10 major secondary veins on each side, margin entire. Inflorescences paniculate, axillary and extra-axillary to distal leaves, 13–18(–32) cm long, 14–16 cm wide, many-flowered, minutely puberulous, peduncles 5–12 cm long, 1.5–2 mm thick with alternating lateral branches, tertiary branches 6–20 mm long, crowded by 6–9 flowers on pedicels 2–4 mm long. Flowers yellow, drying dark, 2–2.2 mm long, 6 tepals, externally very short puberulous, internally villous with whitish hairs; 3 fertile stamens, 1 mm long, strongly connivent forming a thick column, filaments not differentiated, anthers ovoid with 2 apical thecae and the small (0.25 mm) valves with extrorse dehiscence near the apex of the stamen; staminodes and glands minute, 0.3–0.5 mm long, tightly pressed together and appearing fused; ovary narrowly ovate, glabrous, pistil 1 mm long, glabrous, style slender, simple, slightly exserted between the fertile stamens. Fruits borne on a broadly conical receptacle 31–42 mm long, 15–30 mm broad at the top, ca. 18 mm deep, longitudinally ridged, with two distinct margins on its rim, lenticellate, green turning red; fruiting pedicels 5–20 mm long, 3–4 mm diam.; berry narrowly ovoid to ellipsoid, 20–25 mm long, 10 mm diam., red to purple at maturity.

Licaria caribaea is currently known only from the Caribbean coastal plain of Costa Rica (hence its name), from 0 to 10 m elevation. It is found in the very wet forest commonly called "yolillales," "Tropical, tropical, very wet with no dry months" biotic unit according to Herrera and Gómez (1993). This new species is associated with *Raphia taedigera* Martius (Arecaceae), *Carapa guianensis* Aublet (Meliaceae), and the legumes *Pentaclethra macroloba* (Willdenow) Kuntze, *Prioria copaifera* Grisebach, and *Crudia acuminata* Bentham, among others. According to Kurz (1982), this new taxon belongs to his subgenus *Guianensis* (which he should have named subg. *Licaria*, because the type of the genus is included in the subgenus, according to van der Werff, in litt., 1996) and keys to *L. excelsa* Kostermans. Kurz's description of *L. excelsa* is rather broad; however, the two species can be readily separated by the following key:

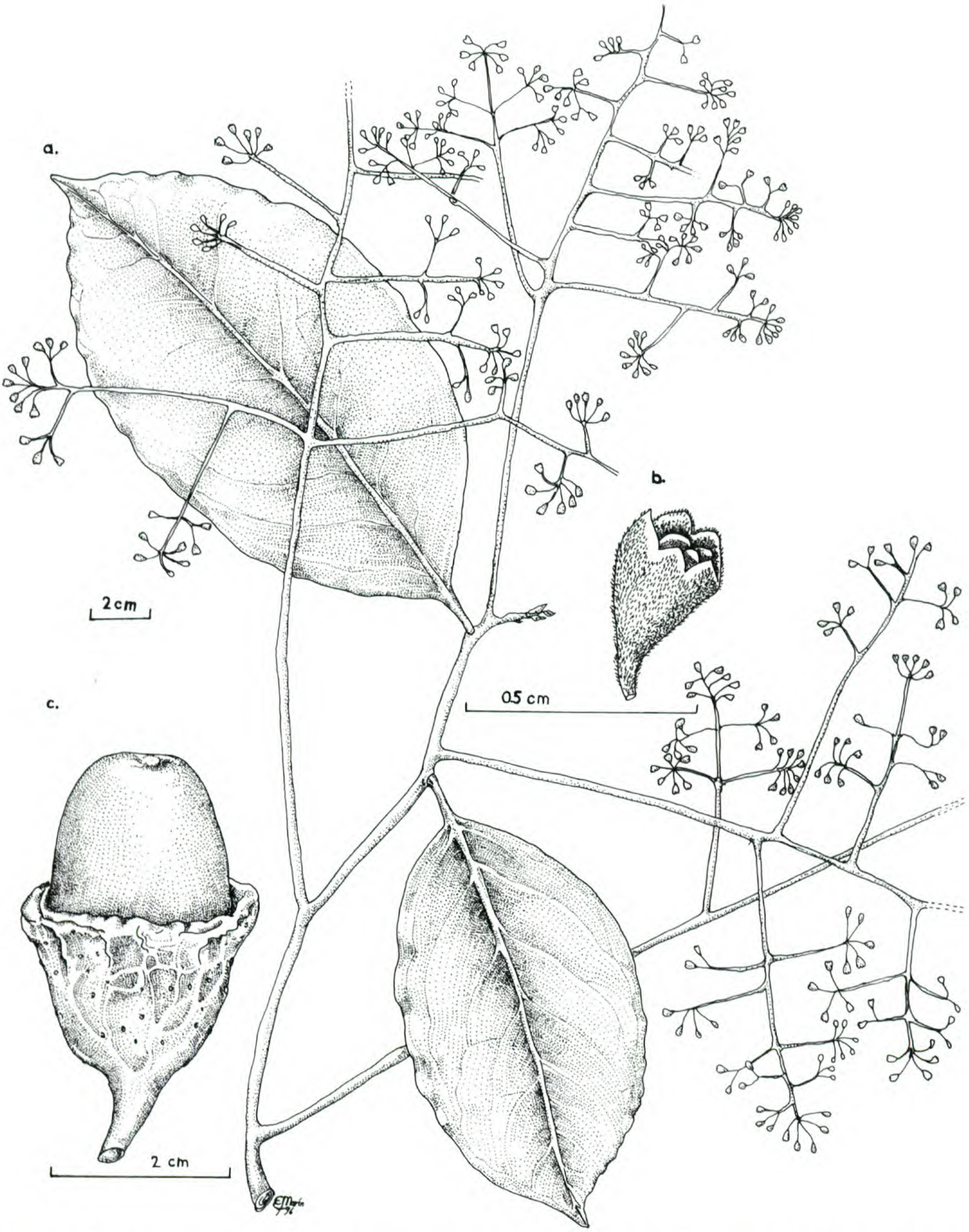

Figure 1. *Licaria caribaea* Gómez-Laurito & Cascante (*A. Cascante & A. Ruiz 705*). —a. Flowering branch. —b. Flower. —c. Fruit.

1a. Trees of medium- to high-altitude habitat,(600–) 1100–2300 m; leaves drying dark in color; inflorescences 5–20 cm long; fruits borne in a cupulate or hemispherical receptacle 13–20 mm long, 18–12 mm broad, not ridged . . . . . *L. excelsa*

1b. Trees of low-altitude habitat, 0–10 m; leaves drying brownish green in color; inflorescences 13–32 cm long, many-flowered; fruits borne in a broadly conical receptacle 31–42 mm long, 15–30 mm broad, longitudinally ridged . . . *L. caribaea*

Paratypes. COSTA RICA. **Limón:** same locality as type, 3 Mar. 1996 (ster.), *A. Cascante & P. Opay 987* (CR, USJ), 3 Mar. 1996 (ster.), *A. Cascante & P. Opay 986* (CR, USJ), 3 Mar. 1996 (fr), *A. Cascante & P. Opay 985* (CR, USJ).

Acknowledgments. We are grateful to Henk van der Werff (MO) and to William C. Burger (F) for critically reading the manuscript, and to Carmen Marín for the illustration. We also thank the Canadian Organization for Tropical Education and Rainforest Conservation (COTERC) for its support during field trips to Caño Palma Biological Station.

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New Combinations and a New Species in the Brazilian Genus *Chaetostoma* DC. (Microlicieae: Melastomataceae)

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ABSTRACT. Four new combinations in *Chaetostoma* (*C. albiflorum*, *C. cupressinum*, *C. selagineum*, *C. stenocladon*,) are proposed, and a new species, *Chaetostoma flavum*, endemic to the Chapada dos Veadeiros, Goiás, Brazil, is described. The new species can be distinguished by its 4–5-locular ovary and antisepalous stamens with prolonged appendages.

Chaetostoma DC. is a genus endemic to Brazil comprising 11 species that occur in campo rupestre, campo de altitude, and campo cerrado vegetation in the states of Goiás, Distrito Federal, Minas Gerais, with a less considerable representation in Bahia, Rio de Janeiro, São Paulo, and Paraná. This genus can be distinguished within the tribe Microlicieae, especially with regard to *Microlicia* D. Don, to which it has the closest affinity, by the combination of the following diagnostic features: carinate, imbricate, and pungent leaves without translucent dots; the mature capsule longer than the hypanthium; and a crown of trichomes around the outward apex of the hypanthium. The distinction between *Chaetostoma* and *Microlicia* has been made by Cogniaux (1883, 1891), in the last revision of these genera, on the basis of just one character: the morphology of the stamens, considered equal in both cycles in *Chaetostoma* and very unequal in *Microlicia*. This character has proven to be unreliable, and the most striking difference between these genera is in the possession of the crown of trichomes on the hypanthium in all species of *Chaetostoma*, which is absent in all species of *Microlicia*. In a recent revision of *Chaetostoma* (Koschnitzke, 1997), some taxonomic novelties were recognized, and it was found necessary to propose some new combinations and a new species for the genus.

Chaetostoma albiflorum (Naudin) Koschnitzke & A. B. Martins, stat. nov. Basionym: *Chaetostoma pungens* DC. var. *albiflorum* Naudin, Ann. Sci. Nat. Bot. Sér. 3, 3: 191. 1845. TYPE: Brazil. Minas Gerais: Serra de Carrancas, 1822, *A. St-Hilaire s.n.* (holotype, P not seen).

Chaetostoma pungens DC. var. *pallidiflorum* Cogniaux, in Martius, Fl. Bras. 14: 32. 1883. Syn. nov. TYPE: Brazil. Minas Gerais: Serra de Itatiaia, Mar. 1839, *Riedel s.n.* [Martii Herbar. Florae Brasil no. 922] (lectotype, selected here, BR; isolectotypes, BM, G, K, W).

Chaetostoma cupressinum (D. Don) Koschnitzke & A. B. Martins, comb. nov. Basionym: *Microlicia cupressina* D. Don, Mem. Wern. Soc. 4: 302. 1823. TYPE: Brazil. Minas Gerais: 6 May 1819, *Sellow 1329* (holotype, BM; isotype, BR).

Chaetostoma luteum Cogniaux, in Martius, Fl. Bras. 14: 589–590. 1888. Syn. nov. TYPE: Brazil. Minas Gerais: São João del Rey, Serra do Lenheiro, 24 June 1887, *Glaziou 16769* (holotype, B destroyed; lectotype, selected here, BR; isolectotypes, C, F, G, K, MO, P, RB).

Chaetostoma lutem Cogniaux var. *quadrifarium* Cogniaux, in A. DeCandolle & C. DeCandolle, Monogr. Phan. 7: 29. 1891. Syn. nov. TYPE: Brazil. Minas Gerais: São João del Rey, Serra do Lenheiro, 24 Jan. 1889, *Glaziou 17503* (holotype, BR; isotypes, BR, C, F, G, K, P, R).

Chaetostoma trauninense Cogniaux, in A. DeCandolle & C. DeCandolle, Monogr. Phan. 7: 30. 1891. Syn. nov. TYPE: Brazil. Minas Gerais: São João del Rey, Serra do Lenheiro, 24 June 1887, *Glaziou 16769a* (lectotype, selected here, BR; isolectotypes, B, C, F, K, RB).

Chaetostoma joannae Cogniaux, in A. DeCandolle & C. DeCandolle, Monogr. Phan. 7: 28. 1891. Syn. nov. TYPE: Brazil. Minas Gerais: Serra do Lenheiro, 1889, *Glaziou 17504* (lectotype, selected here, BR; isolectotypes, B, BR, C, F, G, K, P).

Chaetostoma selagineum (Naudin) Koschnitzke & A. B. Martins, comb. nov. Basionym: *Microlicia selaginea* Naudin, Ann. Sci. Nat. Bot. Sér. 3, 3: 188. 1845. TYPE: Brazil. Goiás: Chapadão, *A. St-Hilaire 550* (holotype, P not seen; isotype, F).

Chaetostoma stenocladon (Naudin) Koschnitzke & A. B. Martins, comb. nov. Basionym: *Microlicia stenocladon* Naudin, Ann. Sci. Nat. Bot. Sér. 3, 3: 188. 1845. TYPE: Brazil. Goiás: Serra dos Pirineus, 17 June 1819, *A. St-Hilaire s.n.* (holotype, P not seen; isotype, F).

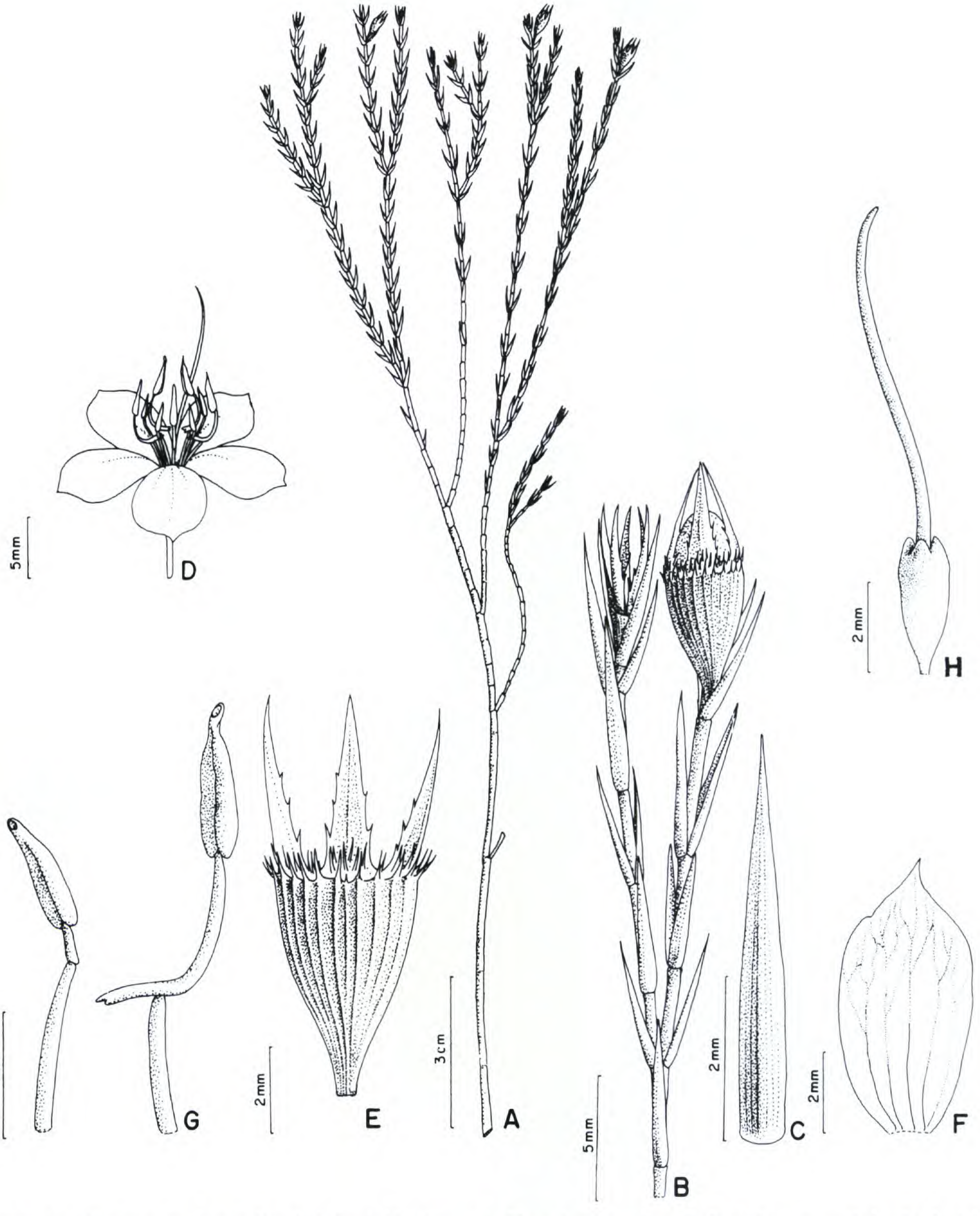

Figure 1. *Chaetostoma flavum* Koschnitzke & Martins. —A. Flowering branch. —B. Branch apex. —C. Leaf (adaxial surface). —D. Flower. —E. Calyx lobes, apex of the hypathium outward with trichomes. —F. Petal. —G. Stamens, antipetalous (left) and antisepalous (right). —H. Ovary and style. Drawn from holotype.

Microlicia amaroi Brade, Arq. Jard. Bot. Rio J. 16: 29. 1959. Syn. nov. TYPE: Brazil. Goiás: Serra dos Pirineus, 17 Feb. 1956, *Macedo 4360* (holotype, Herbarium A. C. Brade & A. Macedo not seen; isotypes, K, S).

Chaetostoma flavum Koschnitzke & A. B. Martins, sp. nov. TYPE: Brazil. Goiás: Alto Paraíso, Chapada dos Veadeiros, 18 Mar. 1976, *Semir 712* (holotype, UEC; isotypes, UEC, MO). Figure 1.

Haec species inter affines petalis flavis, hypantho subtiliter striato, trichomatibus brevibus incrassatis superne circumcirca ornato, connectivo antherarum maiorum longe producto et praecipue ovario 4–5-loculari distinguitur.

Erect and caespitose subshrub 30–100 cm tall, branching dichotomous or trichotomous, branches fastigiate, glabrous, and articulate. Leaves caducous with age, imbricate, adpressed, erect, sessile and semiamplexicaul, blade 3–7 × 0.8–1 mm, keeled, coriaceous, triangular-lanceolate, acute at the apex, pungent, margins entire or serrulate-ciliate, abaxial surface glabrous, adaxial surface with short trichomes, 5-nerved. Flowers 5-merous, solitary, terminal, without bracts, sessile; hypanthium 2.5–4.5 mm long, oblong-campanulate, ribbed, glabrous or rarely pubescent, apex outward with short and thick adpressed trichomes; calyx lobes 3–4 mm long, 1–2 mm wide at the base, persistent, erect, subcarinate, triangular-lanceolate, acute at the apex, pungent, margins inconspicuously serrulate-ciliate, abaxial surface glabrous, adaxial surface with short trichomes, 5-nerved. Petals 8–11 × 4–7 mm, irregularly and broadly obovate, acuminate at the apex, yellow; antisepalous stamens five, 9–13 mm long, filaments 4–5 mm long, anthers tetrasporangiate, 2–3 mm long, yellow, oblong with a small and single pore, dorsally inclined in both series, connective 3–5 mm prolonged below the thecae, appendage 1–2 mm, bilobed; antipetalous stamens five, 5–7 mm long, filaments 4 mm long, anther 1.5–2.5 mm long, similar to the antisepalous, connective 1 mm prolonged below the thecae, appendage small, tuberculate; ovary 4–5-locular, 2–4 mm long, oblong, glabrous, style 5.5–7 mm long, stigma punctiform. Fruit capsular, 4–5 mm long, completely covered by the hypanthium and loculicidally dehiscent in the upper part; seeds numerous, 0.6–0.65 mm long, slightly curved, testa reticulate-foveolate, anticlinal walls undulated.

Chaetostoma selagineum is closely related to *C. flavum* because of its acute and pungent leaves, slightly ribbed hypanthium, yellow petals, and connective of the antisepalous stamens with prolonged appendages. *Chaetostoma flavum* has a sessile hypanthium, 4–5-locular ovary, and a seed testa with undulated anticlinal walls, while *Chaetostoma selagineum* has a pedunculate hypanthium, 3-locular ovary, and seeds with straight anticlinal walls.

Chaetostoma flavum is endemic to the Chapada dos Veadeiros, Goiás, Brazil, in areas with stony and sandy soils. It has been collected flowering from January until August and with fruits in January and June.

Paratypes. BRAZIL. **Goiás:** Alto Paraíso: rio Piçarão, *Glaziou 21212* (BR, C, G, P); Chapada dos Veadeiros, *Anderson 6707* (F, MO, RB, US), *Dawson 14692* (US), *Gates & Estabrook 13* (SP), *Irwin et al. 24676* (F, MO, US), *Oliveira & Anderson 471* (CAS, MBM); Serra dos Veadeiros, *Glaziou 1895* (P). Niquelândia: Estrada da mina de níquel, *Fonseca et al. 167* (UEC).

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A Revised Taxonomy for Two North American *Rhynchospora* (Cyperaceae) and for Two North American *Xyris* (Xyridaceae)

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ABSTRACT. Changes in taxonomic rank are proposed for two North American *Rhynchospora* (Cyperaceae) and for two *Xyris* (Xyridaceae): *Rhynchospora recognita* (Gale) Kral, *Rhynchospora harveyi* W. Boott var. *culixa* (Gale) Kral, *Xyris laxifolia* Martius var. *iridifolia* (Chapman) Kral, and *Xyris stricta* Chapman var. *obscura* Kral. The morphologic basis for such changes is given.

In the process of preparing treatments of *Rhynchospora* (Cyperaceae) and Xyridaceae for the *Flora of North America*, and for the sake of a consistent taxonomy in both, the following efforts are made.

1. Rhynchospora recognita (Gale) Kral, stat. nov. *Rhynchospora globularis* (Chapman) Small var. *recognita* Gale, Rhodora 46: 245. 1944. TYPE: U.S.A. Virginia: Sussex Co., dry pinelands, 4 mi. NW of Waverley, 26 July 1936, *Fernald & Long 6070* (holotype, GH; isotype, PH).

Whatever its name or rank, *Rhynchospora recognita*, as proposed herein, had, from the time of Muhlenberg and Elliott to the Gale and Fernald revisions, been thought to be *R. cymosa*. As carefully pointed out by Gale (1944), the specific epithet "cymosa," based on *Schoenus cymosus* Willdenow (actually a specimen of *Scirpus polyphyllus* Vahl), had been consistently misapplied by authors since Elliott (1821), who used it for the already published *R. glomerata* (L.) Vahl. Thus, it was Gale's decision to solve the problem by utilizing Small's (1933) *R. globularis* (Chapman) Small, itself based on Chapman's description of *R. cymosa* var. *globularis* Chapman (1860: 525). This, in Gale's treatment and in others since, is the shorter, more slender plant that provides a working concept for typical *R. globularis*. Gale also then assigned a new name, "recognita," to the larger, coarser plant previously (and erroneously) named *R. cymosa*, making it a variety of *R. globularis* along with the southeastern U.S. and West Indian plant formerly called *R. pinetorum* Britton & Small. Kükenthal (1950) in his revision of *R.* sect. *Globulares* adopted the essentials of Gale's treatment of *Rhynchospora globularis* varieties, simply adding two more to the list, with *R. obliterata* Gale and *R. saxicola* Small thus becoming *R. globularis* var. *obliterata* (Gale) Kükenthal and *R. globularis* var. *saxicola* (Small) Kükenthal.

After many years of field and herbarium experience with this complex of *Rhynchospora*, and after recent examination of many large loans, I have continued to note that Gale's variety *recognita* is actually a species distinct from *R. globularis* and its varieties. Authors such as Muhlenberg, Torrey, Gray, Chapman, and Small were well aware of it as a species even if they did not realize what the correct name for it was. Also, thanks to Gale and Kükenthal, we have a better idea of what the real *R. globularis* is.

I have: (1) in Table 1 prepared a list of several character states by which *Rhynchospora recognita* is compared with *R. globularis* and its varieties; (2) illustrated an example of *R. recognita* (Fig. 1) and *R. globularis* together with fruits of its varieties (Fig. 2); and (3) shown the eastern North American mapped distributions for the species and varieties in Figure 3A–D (*R. recognita*, *R. globularis* var. *globularis*, *R. globularis* var. *pinetorum*, and *R. globularis* var. *saxicola*, respectively).

From Table 1, it can be seen that *Rhynchospora recognita* is the more robust, taller, stiffer plant, with bracts and bractlets more exserted, with rust-red spikelets mostly longer, and with longer fruits than is true for *R. globularis* and its varieties. From the maps in Figure 3 it can be seen that *R. recognita* has the widest range, and that the *R. globularis* varieties are largely nested within it. The maps in Figure 3 do not show total distributions: *R. recognita* and *R. globularis* var. *globularis* have populations in northern California, and the former is well represented in the West Indies, Mexico, and Mesoamerica; *R. globularis* var. *pinetorum* extends south from Florida into the Antilles. However, the area of greatest sympatry is within the Coastal Plain of the eastern U.S., particularly in moist sandy peats or sandy clays of flatwoods, savanna, ditches,

Table 1. Comparison of 11 character states in *Rhynchospora recognita* and *R. globularis*.

	Rhynchospora recognita	*Rhynchospora globularis* and vars.
Habit	perennial, culms stiff, erect, 6–10 dm	perennial, culms slender, lax to stiff, erect to excurved or spreading, (1–) 2–6(–8) dm
Leaves	blades 2–5 mm wide	blades 1–3 mm wide
Inflorescence compounds, spikelet clusters	compounds of clusters (fascicles) (1–) 2–4(–5), the terminal and the lateral exceeded by subtending bract; spikelet clusters (fascicles) dense, exceeded by involucral bractlets giving them a "bristly" look	compounds of clusters (fascicles) (1–) 2–3(–4), the terminal compound usually exceeding the subtending bract; spikelet clusters of fewer spikelets, arranged in more diffuse compounds, exceeding their subtending bractlets, thus lacking a "bristly" look
Spikelets	ovoid to narrowly ovoid, 3–4 mm, acute to acuminate, red-brown	ovoid to subglobose, 2.5–3(–4) mm, broadly acute to obtuse, brown to deep brown
Fertile scales	ovate, 2.5–3 mm, convex, acute to obtuse or emarginate, midcosta often excurrent as cusp or arista	broadly ovate to orbicular, 1.7–2.3 mm, deeply convex, obtuse to rounded or emarginate, midcosta mostly included, sometimes excurrent as apiculus
Stamens, anthers	2–3, 2 mm	1–3, 1.5(–2) mm
Fruit	body obovoid-lenticular, tumid	body broadly obovoid-lenticular to suborbicular-lenticular, tumid
Fruit length (including tubercle)	2–2.3 mm	1.5–2 mm
Tubercle	compressed-conic, (0.4–)0.5–0.6(–0.8) mm	depressed-conic to almost patelliform, never exceeding 0.5 mm
Sculpture of fruit body	transverse rows of vertical, narrowly rectangular cancellae, contiguous endwalls producing sharp, wavy transverse rugosity	transverse rows of vertical, narrowly rectangular cancellae, contiguous endwalls producing sharp, wavy, transverse rugosity, or merely isodiametrically reticulate-cancellate
Perianth	bristles usually 6, extending to fruit midbody	bristles usually 6, various lengths

and shorelines. All of these particular species and varieties are aggressively weedy and are quick to invade timbered lowlands, areas that have undergone mechanical or fire disturbance, low areas in abandoned fields, and sandy shores of artificial impoundments. It is not rare to see a majority of these taxa mingling in the same site; in fact, I have collected all of them together on and around outcroppings of the Altamaha Grit in southern Georgia pinelands. In such cases there are no evidences of intergradation, and *R. recognita*, taller and more robust, puts its bristly-looking rusty spikelet clusters at a level well above the lower, more lax and spreading culms of darker-spikeleted *R. globularis*.

Since the type chosen by Gale is represented by only two specimens, I have distributed two representative sets, namely: U.S.A. **Alabama:** Cullman Co., *R. Kral 84838* (APSC, BM, BRCH, CLEMS, CM, CTB, F, FLAS, FSU, GA, GH, K, KANU, MICH, MEM, MO, MSC, NCU, NY, OS, TENN, TEX, UNA, USCH, VDB, VSC, WAT, WILLI, WIS); Shelby Co., *R. Kral 80984* (BM, BRCH, CH, CM, CTB, FSU, GH, K, KANU, MICH, MO, MU, M, NCU, PH, SMU, VDB, VPI, VSC, WILLI, WIS).

2. **Rhynchospora harveyi** W. Boott var. **culixa** (Gale) Kral, comb. nov. Basionym: *Rhynchospora culixa* Gale, Rhodora 46: 235. 1944. *Rhynchospora grayii* Kunth var. *culixa* Kükenthal, Bot. Jahrb. Syst. 75(1): 120. 1950. TYPE: U.S.A. Georgia: Tift Co., Irby, 28 Aug. 1890, *S. M. Tracy 1498* (holotype, US).

Gale described this plant as a species most closely resembling *Rhynchospora harveyi*, differing from it mostly in its more slender, shorter-leaved culms, its smaller, more compact spikelet clusters, and its fruits tending to be obovoid rather than el-

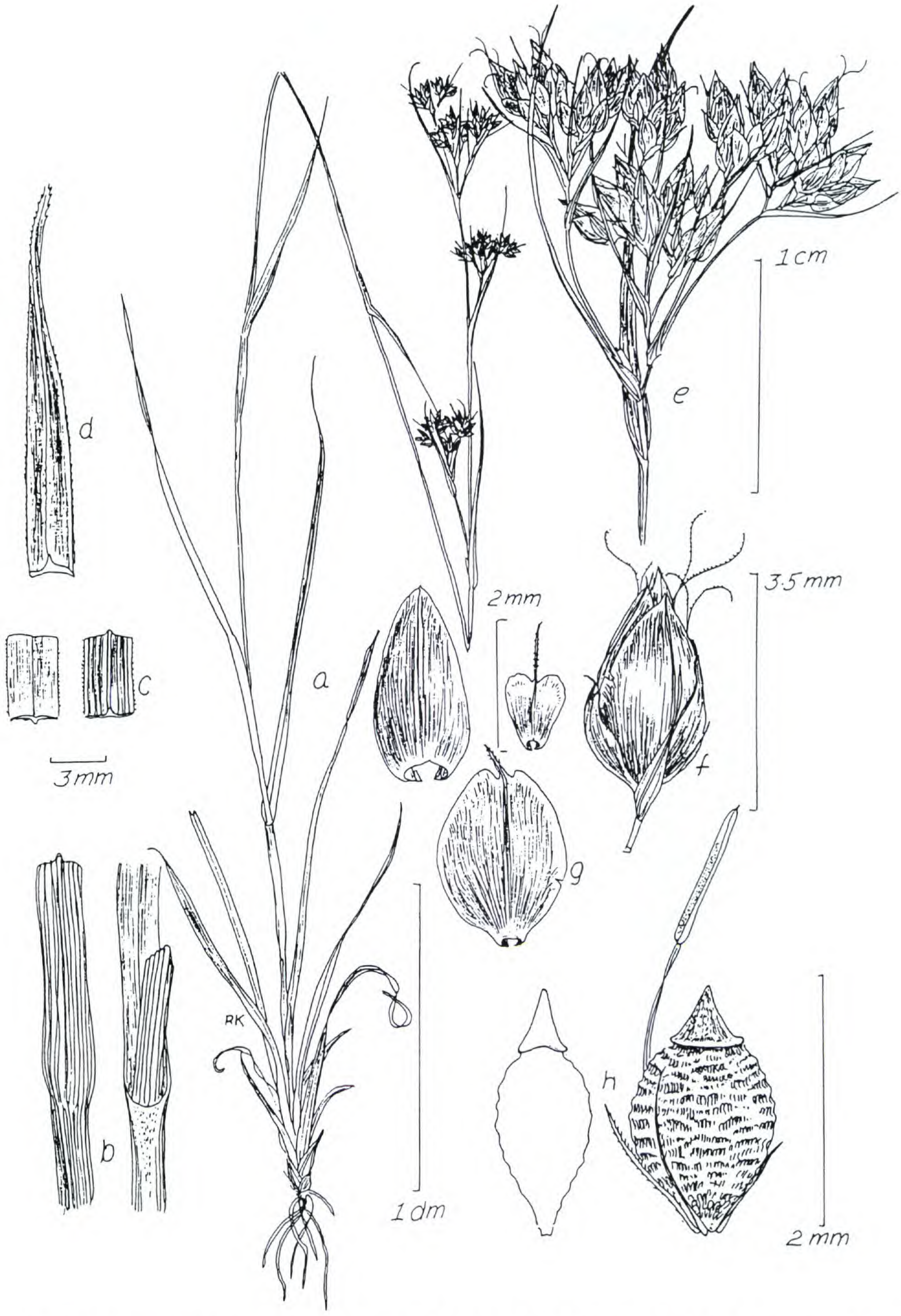


Figure 1. *Rhynchospora recognita* (*Kral 84838*). —a. Habit sketch. —b. Leaf at sheath-blade junction, abaxial (left), adaxial (right). —c. Leaf midblade, adaxial (left), abaxial (right). —d. Leaf apex. —e. Inflorescence, apical compound. —f. Spikelet. —g. Lowest sterile scale (upper right); upper sterile scale (lower right); fertile scale (upper left). —h. Fruit, achene showing perianth, tubercle, hypogynous stamen (right); fruit outline (left).

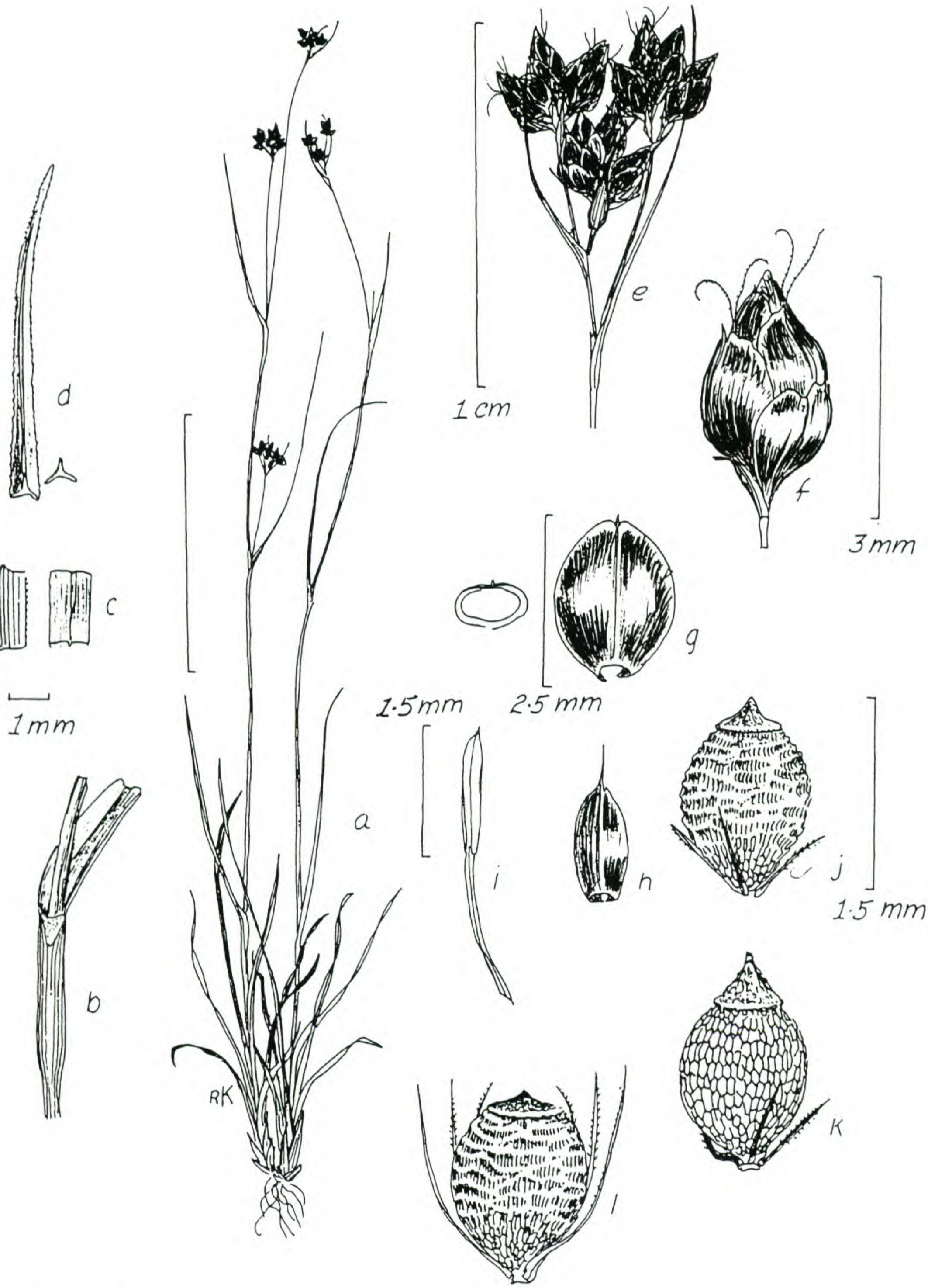
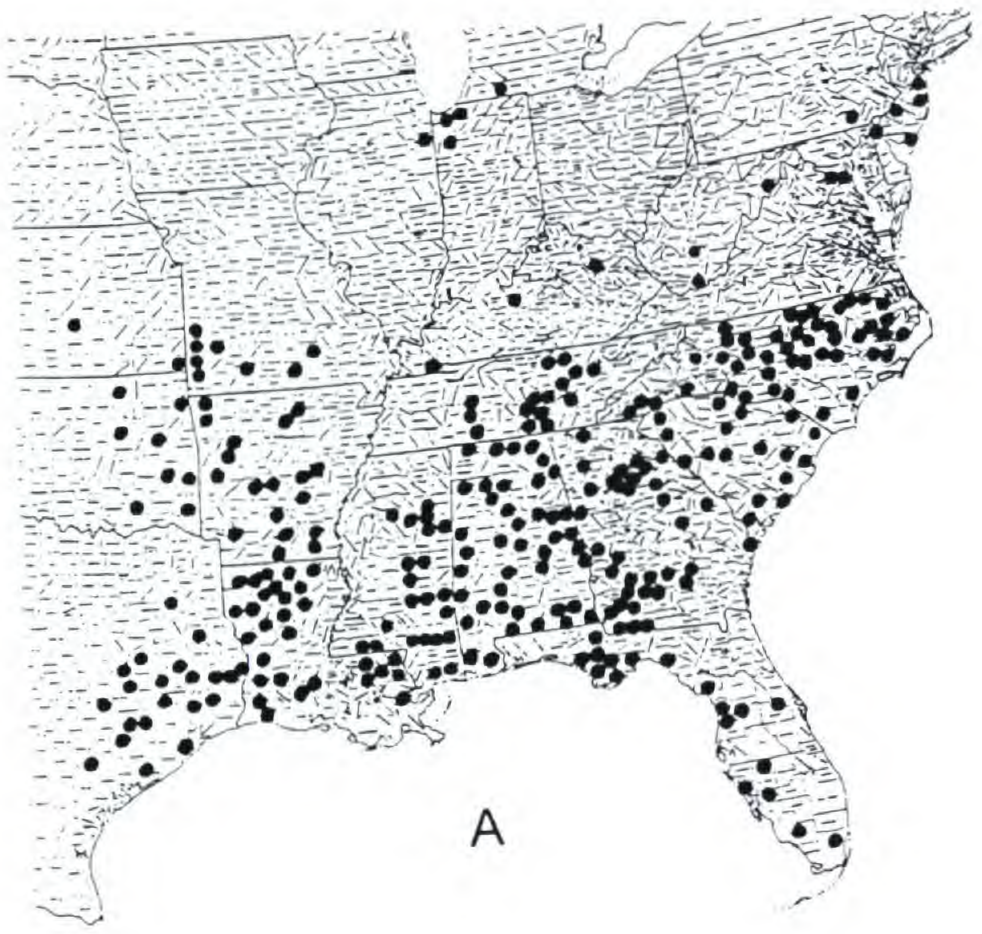
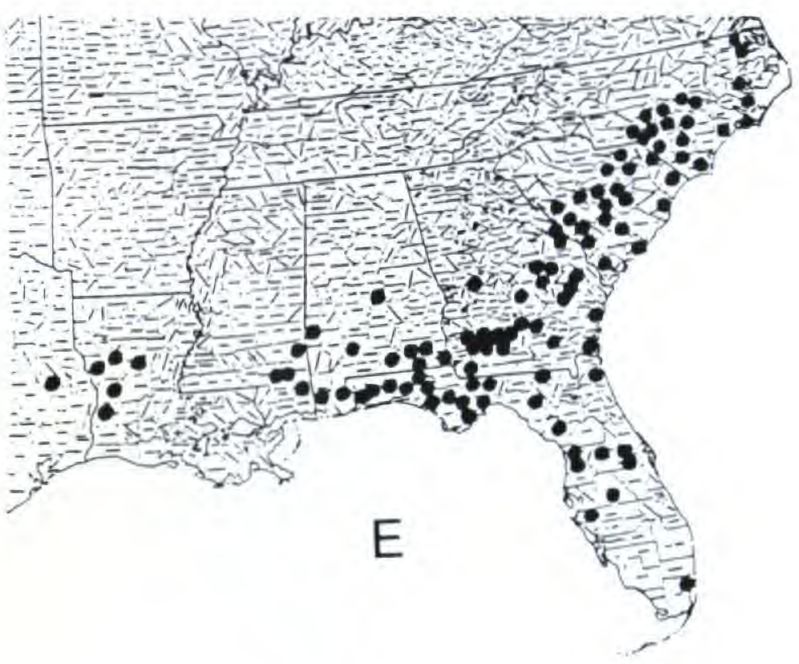
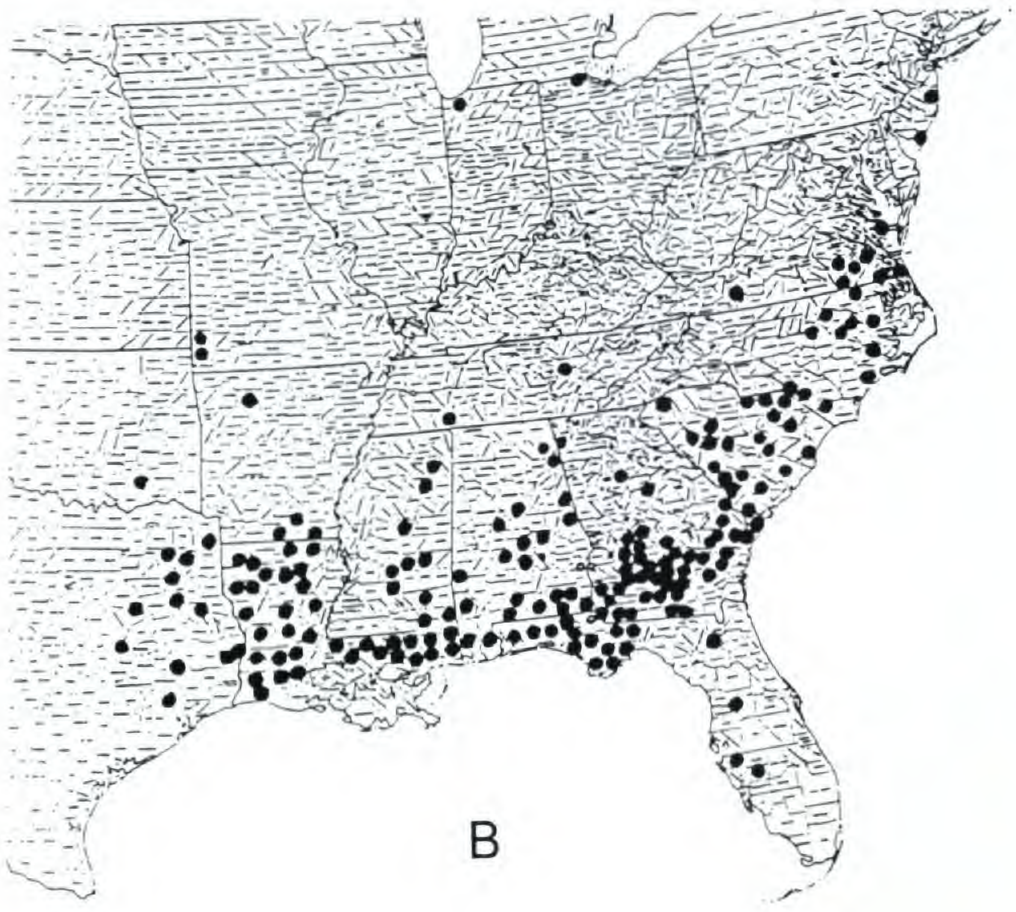


Figure 2. *Rhynchospora globularis* var. *globularis* (*Kral 84527*). —a. Habit sketch; scale bar = 1 dm. —b. Leaf blade, sheath junction. —c. Leaf midblade, abaxial (left), adaxial (right). —d. Leaf apex. —e. Inflorescence, apical compound. —f. Spikelet. —g. Fertile scale, adaxial view (right), cross section with enclosed fruit, sketch (left). —h. Lowest sterile scale. —i. Distal part of filament, with anther. —j. Fruit. —k. Fruit of *R. globularis* var. *pinetorum* (*Kral 7031*). —l. Fruit of *R. globularis* var. *saxicola* (*Kral 80854*).







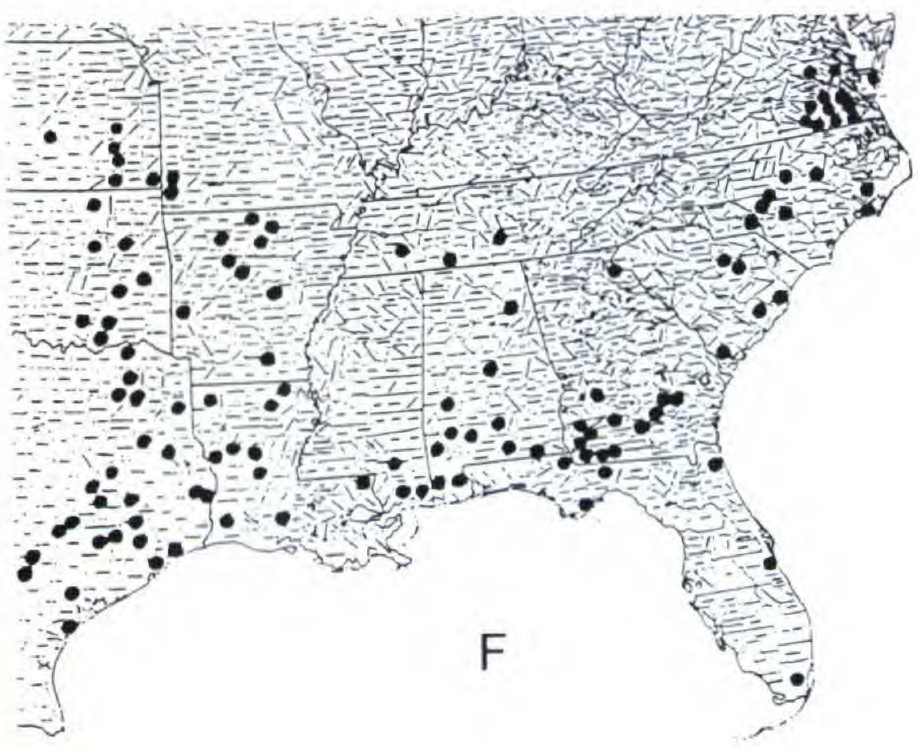


Figure 3. Distribution maps. Dots indicate taxa occurrence by county in eastern North America. —A. *Rhynchospora recognita* (Gale) Kral. —B. *Rhynchospora globularis* (Chapman) Small var. *globularis*. —C. *Rhynchospora globularis* var. *pinetorum* (Britton & Small) Gale. —D. *Rhynchospora globularis* var. *saxicola* (Small) Kükenthal. —E. *Rhynchospora grayii* Kunth. —F. *Rhynchospora harveyi* W. Boott var. *harveyi*. —G. *Rhynchospora harveyi* var. *culixa* (Gale) Kral.

Table 2. Comparison of 10 character states in three *Rhynchospora* taxa

	Rhynchospora grayii	*Rhynchospora harveyi* var. *culixa*	*Rhynchospora harveyi*
Plant height	5–13 dm	5–7 cm	5–11 dm
Principal leaves, length × width	2–4 dm × (1–)1.5–3 mm	1.5–3 dm × 1.5–2 mm	1.5–3 dm × 1.8–3 mm
Spikelet clusters	1–4, turbinate to hemispheric, uppermost exceeding or exceeded by subtending setaceous bract	2–4, turbinate to hemispheric, uppermost sparse, exceeding subtending setaceous bract	2–4, turbinate to hemispheric, uppermost dense, exceeded by 1 or more subtending bracts
Spikelet shape, dimensions, color	ovoid to lanceolate-ovoid, 5–6(–7.5) mm narrowly acute, mostly dull pale brown	narrowly ovoid, 5–6 mm acute, pale brown	ovoid to broadly ovoid, 3–3.5 (–4) mm, broadly acute, pale brown to red-brown
Fertile scales	broadly elliptic to ovate or orbiculate, 4–5 mm	broadly ovate to suborbiculate, 2.5–3.5 mm	broadly ovate to suborbiculate, 2.5–3.5 mm
Stamen number, anther length	3(–6), ca. 3 mm	3, 2–2.2 mm	3, 1.5–2 mm
Fruit body	broadly obovoid to subglobose or broadly ellipsoid, 2–2.5 mm, mostly tumidly lenticular to nearly round in cross section	obovoid, ca. 1.5–1.6 mm lenticular distally	obovoid to broadly ellipsoid, 1.5–1.7 mm, nearly round in cross section
Fruit surface	dark brown, with transverse wavy lines of tiny, raised or pitlike cancellae	brown, with transverse wavy lines of small vertical, short-rectangular pits alternating with low, smooth wavy ridges	dark brown to brown, with undulant-transverse lines of small, pitlike or raised cancellae, alternating with narrow low ridges, or very finely cancellate
Tubercle	buttressed, depressed-conic, 0.3–0.5(–0.7) mm high	buttressed, conic, 0.3 mm high	buttressed, conic, 0.3–0.5(–0.7) mm high
Perianth bristles	mostly 6, reaching at least to tubercle base	6, none reaching past fruit midbody	(1–)3–6, 3 usually rudimentary, none reaching past fruit midbody

lipsoid, less swollen distally, and with a broader, paler transverse rugosity.

Six years later, Kükenthal took a much more conservative approach, reducing the four taxa treated by Gale in her series *Harveyae* to two species, *Rhynchospora megalocarpa* A. Gray and *R. grayii* Kunth, placing both *R. harveyi* and *R. culixa* under the latter as varieties.

In my opinion, this shared not just by Gale but by most of those who have field experience with these plants, *Rhynchospora harveyi* is a well-recognized, wide-ranging, and distinctive species. It is frequent to abundant over many physiographic provinces in North America, from the Great Plains eastward through much of the Gulf and Atlantic Coastal Plain, inland through some Appalachian provinces into the Central Plains (see Fig. 3F). Therefore, it is well represented in systematics collections and exhibits considerable variation. One of these variants, consisting of two collections, one from Georgia the other from northern Florida, was noted by Gale as specifically distinct.

Some realignments appear to be in order. The relationships of taxa within Gale's series *Harveyae* appear, on a basis of comparisons of dried specimens and of living plants, to be much as she had them, and *Rhynchospora harveyi* should be extricated from *R. grayii*. The only change from Gale's work would be simply to show a closer taxonomic relationship of *R. culixa* to *R. harveyi* than she proposed, namely that its relationship be varietal.

In Table 2, *Rhynchospora grayii*, *R. harveyi* var. *culixa*, and *R. harveyi* var. *harveyi* are compared morphometrically, and all three are illustrated in Figures 4, 5, and 6, respectively. Data in Table 2 suggest that (1) *Rhynchospora harveyi* stands distinctly apart from *R. grayii* as a species and (2) *R. culixa* overlaps too much in character with *R. harveyi* to be considered as more than a variety of it.

Gale based *Rhynchospora culixa* upon only two

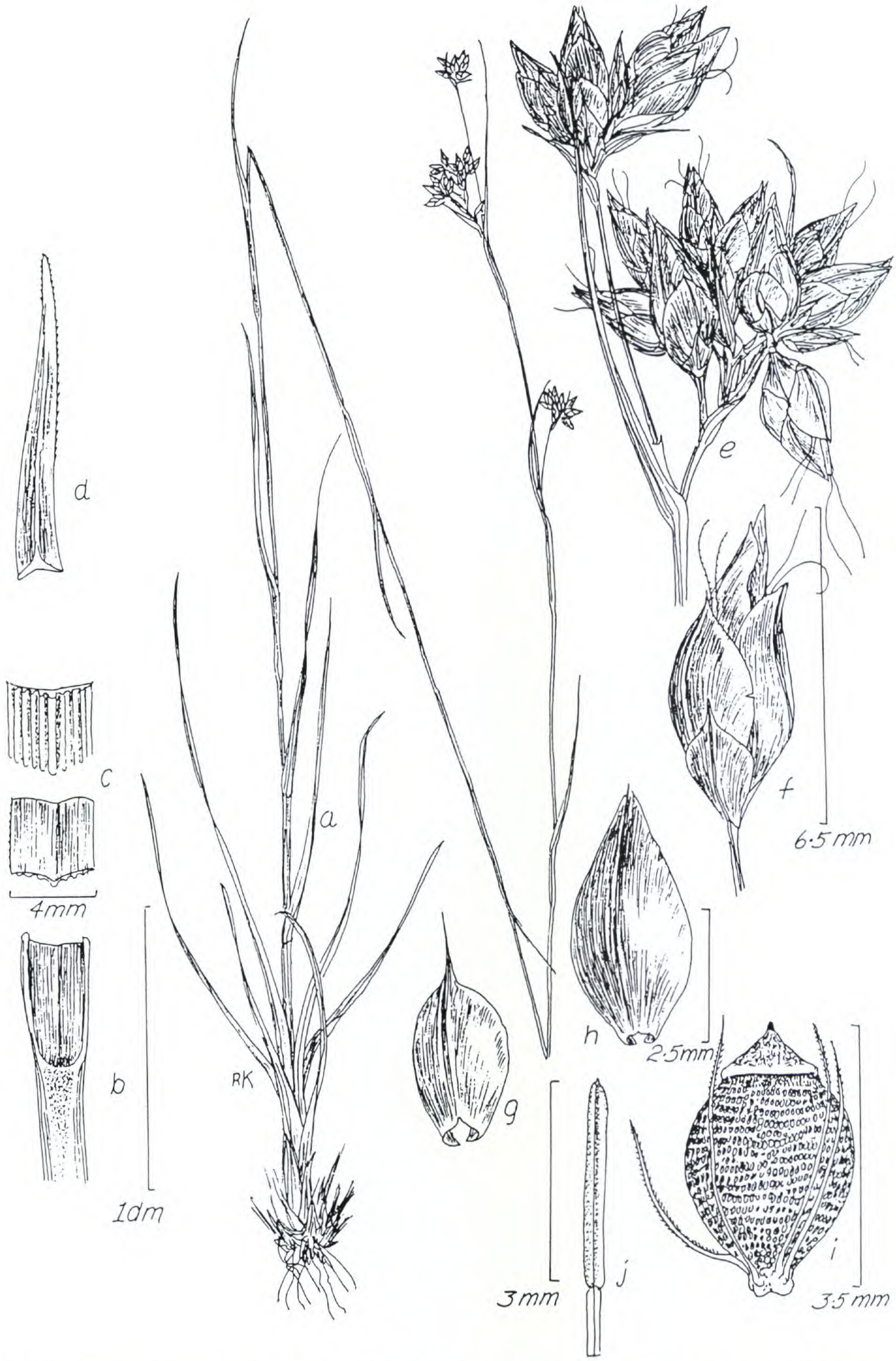


Figure 4. *Rhynchospora grayii* Kunth (*Kral 39617, 84512*). —a. Habit sketch. —b. Leaf sheath-blade junction. —c. Leaf midblade, abaxial (above), adaxial (below). —d. Leaf apex. —e. Upper portion of inflorescence. —f. Spikelet. —g. Sterile scale. —h. Fertile scale. —i. Fruit. —j. Distal part of filament with attached anther.

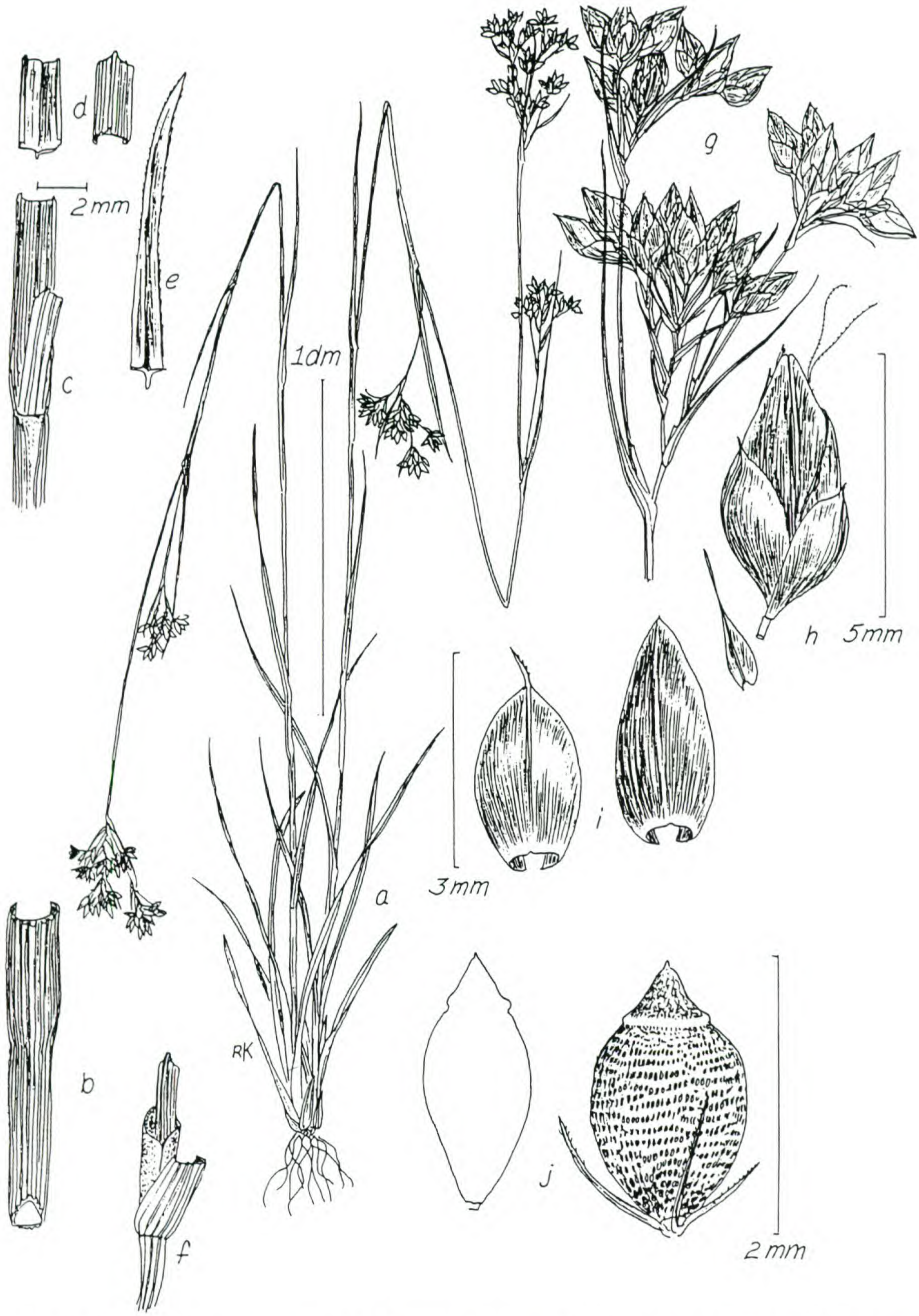


Figure 5. *Rhynchospora harveyi* var. *culixa* (*Kral 80621, 80654*). —a. Habit sketch. —b. Leaf sheath-blade junction, abaxial view. —c. Leaf sheath-blade junction, adaxial view. —d. Leaf midblade, adaxial (left), abaxial (right). —e. Leaf apex. —f. Inflorescence branch, showing bract base and prophyll. —g. Apical inflorescence group. —h. Spikelet (right), lowest sterile bract (left). —i. Upper sterile bract (left), fertile bract (right). —j. Fruit, face view (right), fruit outline (left).

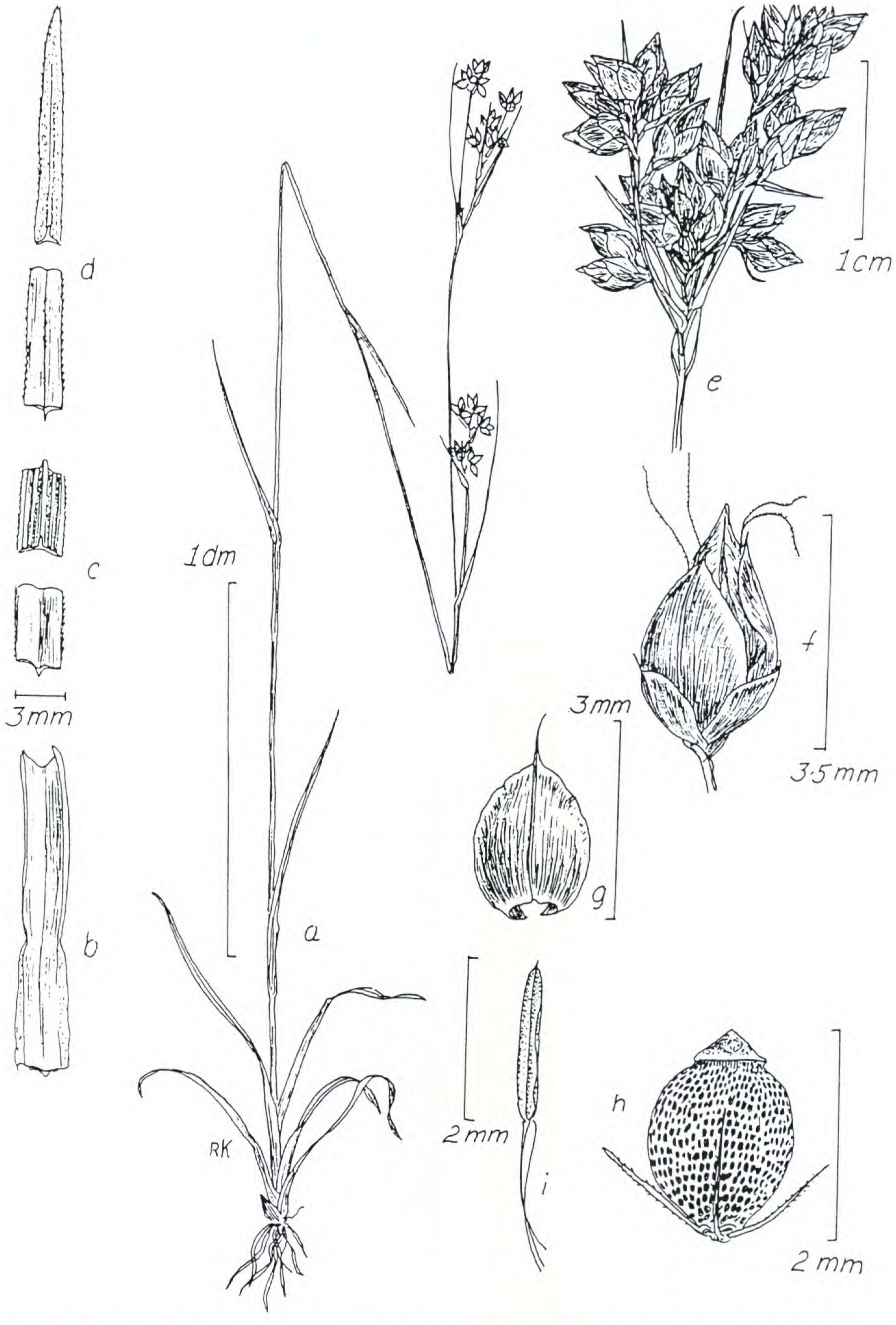


Figure 6. *Rhynchospora harveyi* var. *harveyi* (*Kral 35104, 53164*). —a. Habit sketch. —b. Leaf sheath-blade junction, adaxial view. —c. Sectors of leaf midblade, adaxial (below), abaxial (above). —d. Leaf apex, adaxial sector (below), abaxial sector with tip (above). —e. Upper part of inflorescence, apical compound. —f. Spikelet. —g. Fertile scale. —h. Fruit. —i. Distal part of filament, with attached anther.

Table 3. Comparison of 11 character states of three *Xyris* taxa.

	Xyris ambigua	*Xyris stricta* var. *obscura*	*Xyris stricta* var. *stricta*
Plant height	3–10 dm	2–9(–10) dm	5–9(–10.4) dm
Leaf orientation	in wide fans	in narrow fans	in narrow fans
Leaf length; blade width	(5–)10–40(–50) cm; (2–)3–7(–10) mm	(15–)20–40(–44) cm; (2–)2.5–3(–5) mm	20–60 cm; 3–8 mm
Leaf sheath color; leaf blade color	stramineous to pale brown; olive or yellow green	purplish to reddish; deep green	purplish to reddish; deep green
Leaf blade margins; distal scape costae	scabro-ciliolate; tuberculate-scabridulous	strongly papillate; densely papillate	smooth to low papillate; low papillate to smooth
Spike symmetry; spike length, apex	commonly ovoid to ellipsoid, rarely short cylindric; 1–2(–3) cm, acute	commonly ovoid to ellipsoid-cylindric, rarely cylindric; 1–2(–2.7) cm, blunt	lanceolate-cylindric to cylindric; (1.5–)2–3(–3.5) cm, blunt
Fertile bracts; outline, length	broadly obovate, rarely suborbicular; 5–8 mm	suborbicular, rarely broadly obovate; 5–6.5(–7) mm	suborbicular, rarely broadly obovate; (5.5–)6–7(–7.5) mm
Fertile bracts, color	matrix lustrous, base deep brown shading distally to pale brown or stramineous	matrix lustrous, base castaneous, shading distally to brown	matrix lustrous, base castaneous, shading distally to brown
Lateral sepals	lanceolate-curvate, 4–7 mm, acuminate, keel equaling wing	lanceolate-curvate, (4.5–)5–6(–7) mm, acute, keel wider than wing	lanceolate-curvate, 5–6.5 mm, keel wider than wing
Petal blades	obovate, 8–10 mm	obtriangular, ca. 5 mm	obtriangular, ca. 5 mm
Seeds	ovoid to broadly ellipsoid, 0.5(–0.6) mm, translucent inose	narrowly ellipsoid to cylindric, 0.6–0.7(–0.8) mm farinose	narrowly ellipsoid to cylindric, (0.55–)0.6–0.8 mm, farinose

specimens. I have now discovered seven Georgia populations, confirming Gale's species. These, all represented by mounted duplicates in VDB at BRIT, are: Berrien Co. (*Kral 24255*), Colquitt Co. (*Kral 80599, 80621*), Cook Co. (*Kral 80652*), Lee Co. (*Kral 65385*), Worth Co. (*Kral 80769, 80780*); see Figure 3G. Ranges for *R. grayii* and *R. harveyi* var. *harveyi* are given in Figure 3E and F.

Rhynchospora grayii differs also in its ecology from *R. harveyi*, being an inhabitant of droughty sandhills, mostly in the longleaf pine-deciduous scrub oak systems. *Rhynchospora harveyi* var. *harveyi* frequents a wide variety of ecological systems so long as they are at least seasonally moist, from basic prairie soils to upland oak-pine sands and clays, pine savanna or flatwoods, occasionally also in sandy ecotones between sandhills and boggy slopes and bottoms. These last systems are the ones in which I have encountered *R. harveyi* var. *culixa*.

3. Xyris laxifolia C. Martius var. **iridifolia** (Chapman) Kral, stat. nov. *Xyris iridifolia* Chapman, Fl. S. U.S. 501. 1860. TYPE: U.S.A. Florida: Franklin Co., "Apalachicola," *A. W. Chapman s.n.* (holotype, NY).

Those who have seen living or preserved specimens of the neotropical *Xyris laxifolia* C. Martius [1841: 58; TYPE: Brazil. Mart. Herb. no. 540 (holotype, M)] and the mostly North American *X. iridifolia* Chapman are struck by how similar the two are. In fact, Malme, long the authority on Xyridaceae, made such observations years ago (Malme, 1913, 1937). Both are robust plants with leaf blades at least 1 cm wide, with leaf sheaths strongly tinged with red or purple; both have broad, somewhat compressed or even acipital, smooth scapes and large (1–4 cm) multiflowered brownish spikes, with contrasting paler greenish dorsal areas. The lateral sepals of both taxa are free, of comparable color and length, oblanceolate, included, mostly elliptic-oblanceolate, with thin, narrow, lacerate-ciliate or lacerate-fimbriate keels. Flowers of both taxa are small and open early in the morning. Seeds of both taxa are opaque, mostly farinous. Thus, when the two are compared, one sees that overlapping limits of variation are significantly many. The features that distinguish the two, for example, spike outline, seed outline and degree of opacity, relative widths of sepal keels, and location of fimbriae and/or ciliae along the keel, are such as to make varieties in a genus such as *Xyris*. What has been called *X. iridifolia* ranges through the Coastal Plain

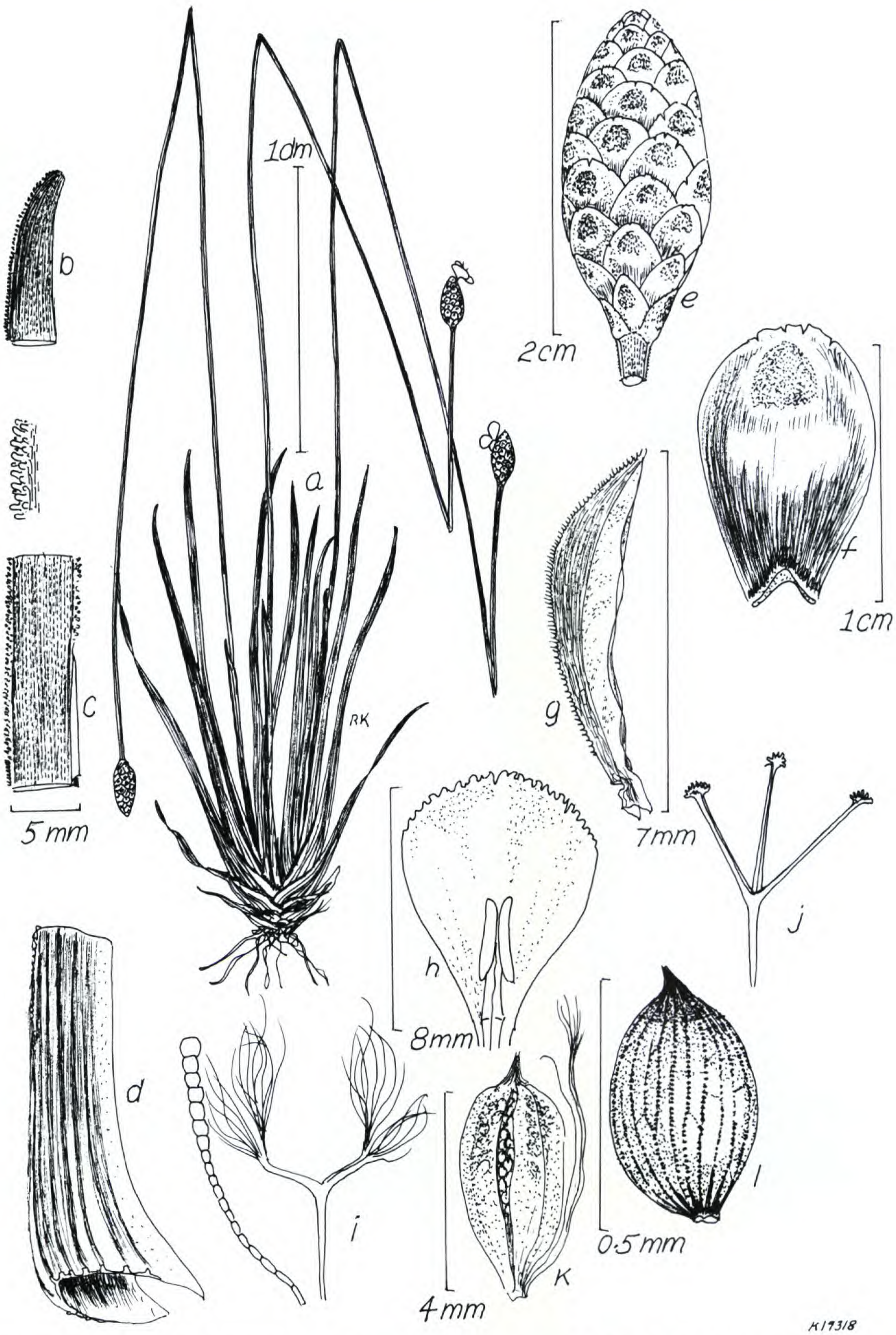


Figure 7. *Xyris ambigua* (*Kral 19318*). —a. Habit. —b. Leaf apex. —c. Leaf blade-sheath junction (below), enlarged leaf blade margin (above). —d. Base of leaf sheath. —e. Spike. —f. Fertile bract. —g. Lateral sepal. —h. Petal blade, stamen. —i. Staminodium (right); enlarged view of beard hair apex (left). —j. Stylar apex. —k. Capsule. —l. Seed.

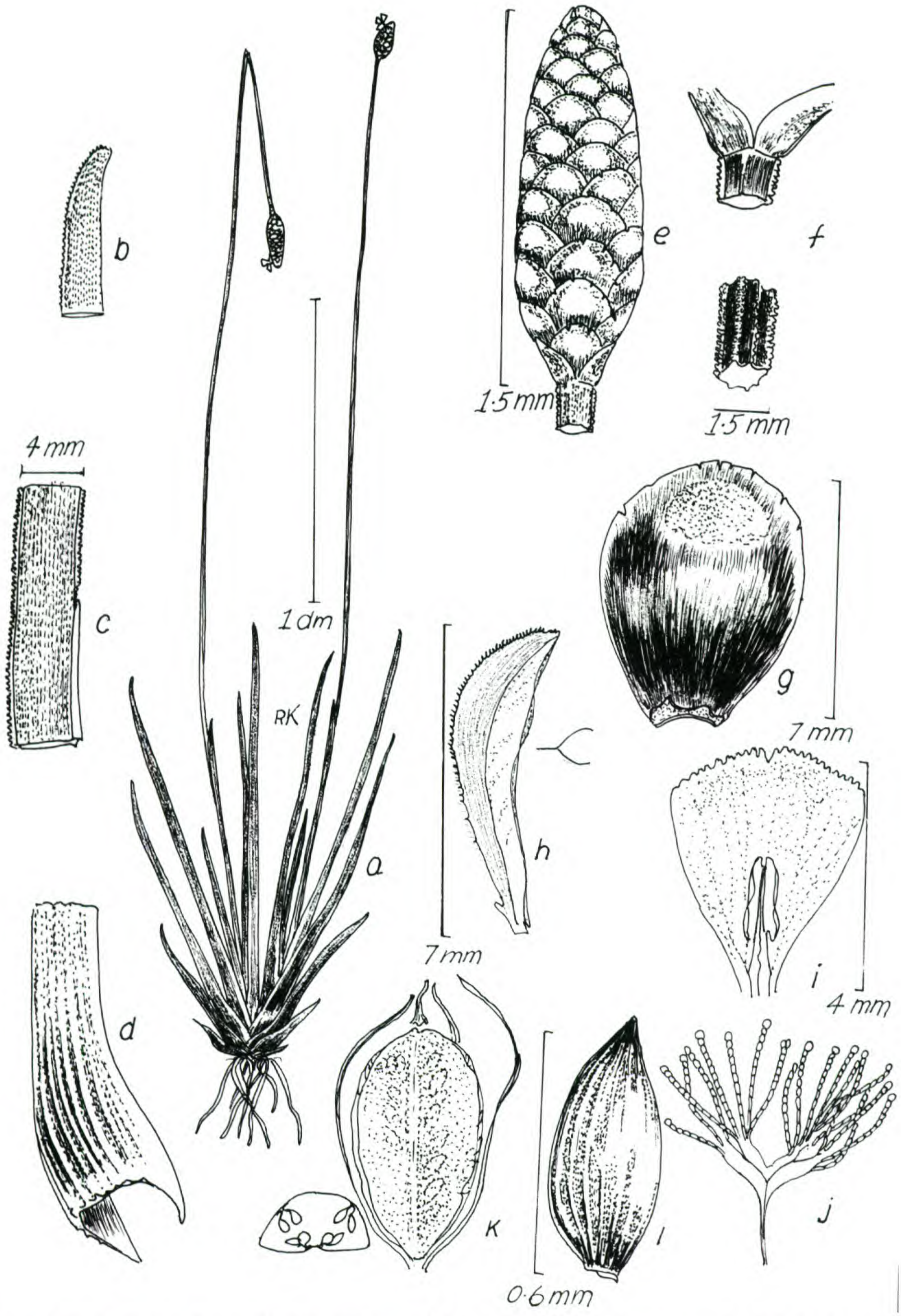


Figure 8. *Xyris stricta* var. *obscura* (*Kral 87830*). —a. Habit sketch. —b. Leaf apex. —c. Leaf blade-sheath junction. —d. Leaf sheath base. —e. Spike. —f. Scape apex, basal spike bracts (above); sector of scape at midscape (below). —g. Fertile bract. —h. Lateral sepal. —i. Petal, stamen. —j. Staminodium. —k. Capsule, adaxial view. —l. Seed.

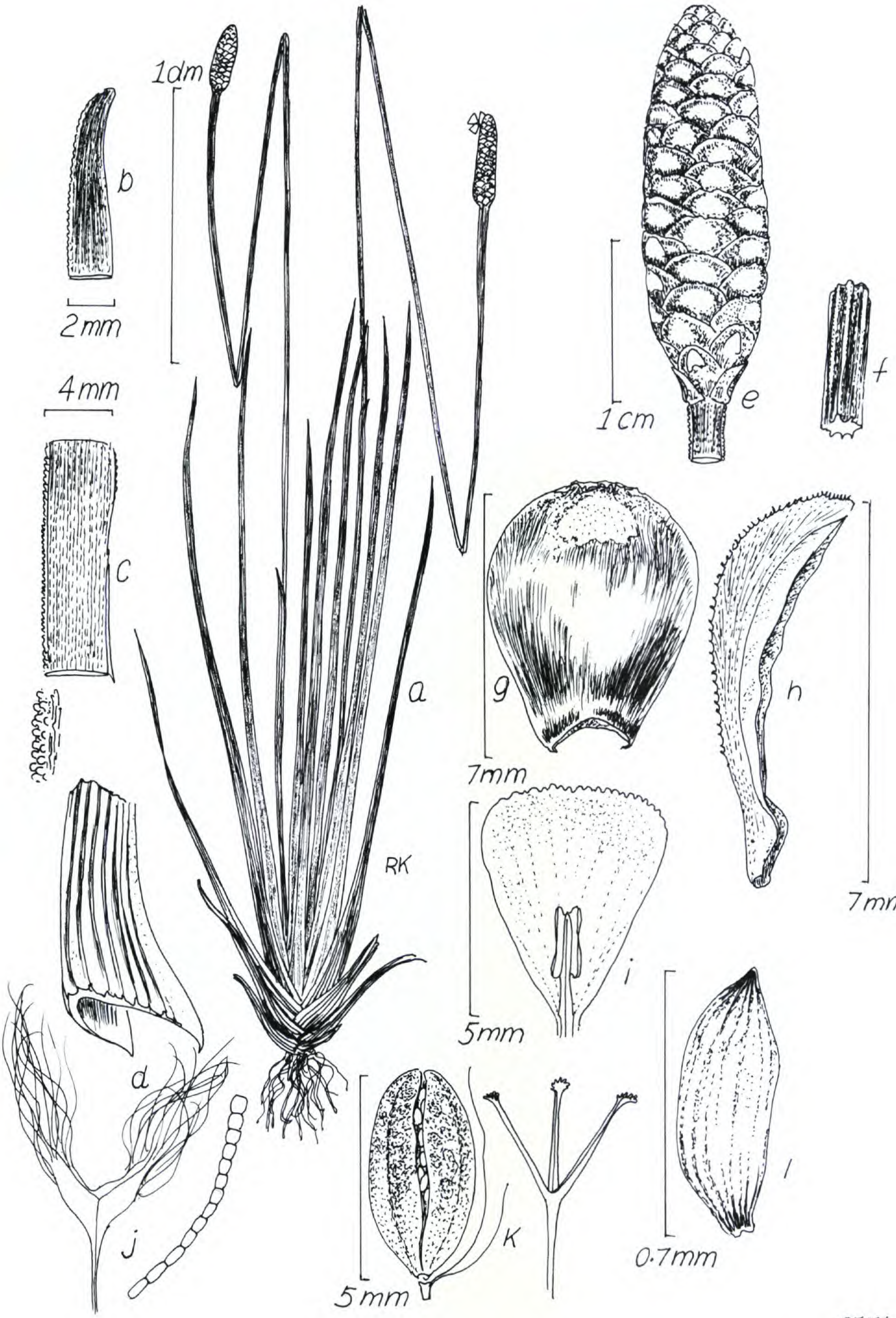


Figure 9. *Xyris stricta* var. *stricta* (*Kral 85336*). —a. Habit sketch. —b. Leaf apex. —c. Leaf blade-sheath junction (above); small sector of leaf blade margin (below). —d. Leaf sheath base. —e. Spike. —f. Sector of midscape. —g. Fertile bract. —h. Lateral sepal. —i. Petal, stamen. —j. Staminodium (left); enlarged beard hair apex (right). —k. Capsule (left); stylar apex (right). —l. Seed.

of the southeastern U.S. from North Carolina to northern Florida, west into eastern Texas, disjunctly in contiguous physiography inland to Oklahoma, Arkansas, Tennessee, and locally in the Piedmont of Georgia and the Carolinas. It reaches the Neotropics in the states of Tobasco and Veracruz, Mexico, and has some recorded stations in Costa Rica and Honduras. Plants identified as *X. laxifolia* overlap *X. iridifolia* types only in Costa Rica, becoming increasingly common southward in Panama, thence southward through most of lowland South America. The two have a similar habitat, namely acidic wet sands and peats of sour swamps and bogs, seeps, shallows, and banks of ponds and disturbed sandy wetlands.

There are a few constant differences, insufficient to distinguish two species but adequate in light of distributional information to propose them as geographic co-varieties.

4. Xyris stricta Chapman var. **obscura** Kral, var. nov. TYPE: U.S.A. Alabama: Washington Co., 12.2 mi. NNW of Citronelle, E side of US 45, fine sandy peat of pine-Willow oak-*Nyssa biflora* flat adjacent to Longleaf pine-evergreen scrub flats, 6 Sep. 1998, *R. Kral 87830* (holotype, VDB; isotypes, BAYLU, BM, BRCH, CLEMS, CM, CTB, DUKE, FLAS, FSU, GA, GH, JSU, KANU, LSU, MICH, MO, NLU, NY, OS, OSC, OSH, PH, TENN, TEX, US, USCH, VSC, WILLI, WIS). Figure 8.

Xyris louisianica Bridges & Orzell, Phytologia 64: 56. 1987. TYPE: U.S.A. Louisiana: Calcasieu Parish, swales and depressions of cutover wetland pine savannah on N side of paved road, ca. 1.3 mi. NW of Edgerly, elev. 23 ft., 24 Sep. 1987, *Orzell & Bridges 5800* (holotype, TEX not seen; isotypes, FSU, GH, LSU, MISSA, MO, NCU, NLU, NY, SMU, TEX, TAMU, VDB).

Differt a *Xyris stricta* var. *stricta* statura minore, laminis foliorum brevioribus, angustioribus, margine scabridioribus, costis scaporum plus scabridis, sepalis lateralibus et seminis brevioribus.

Slender but stiff, solitary to caespitose perennial 30–80(–90) cm high, with base slightly dilated, enfolded in chaffy or fibrous brownish bases of older leaves. Principal leaves ascending in narrow fans, (15–)20–35(–40) cm, longer than the scape sheaths; sheaths entire, ¼–⅓ as long as blades, gradually narrowing from broad, brown to red-brown bases to blade, eligulate; blades narrowly gladiate-linear or linear, 2–5(–7) mm wide, narrowing above middle to an incurved-acute, slightly callused tip, the margins a narrow, pale, and scabridulous band, surfaces faintly multinerved, dull green shading to reddish brown or purplish. Scape sheaths loosely tubular, with narrow, sharp costae abaxially, adaxially scarious, pale, the open oblique orifice narrowed to a short, flattened, blunt cusplike blade. Scapes slightly compressed distally, 1.5–2(–2.4) mm wide, often ancipital with two flattened scabridulous costae making edges, and often with additional low, papillate costae, medially and proximally subterete or angulate, 1–1.5 mm thick, generally multicostate, the costae usually papillate. Spikes mostly ovoid to ellipsoid to cylindric, 1–2(–2.5) cm long, mostly blunt of many, tightly spirally imbricate bracts, the sterile ones few, keeled, ca. 2–4 mm, grading larger into broadly obovate to suborbicular or reniform, convex fertile ones (4–)4.5–6(–7) mm, with entire margins lacerate in age, surfaces castaneous proximally, tan distally, and with subapical ovate to triangular or reniform green dorsal areas. Lateral sepals subequilateral, oblanceolate, (4–)4.5–6 mm, acute. Petal blades obtriangular, 3–4 mm, the very shallowly rounded apex erose. Stamens with anthers broadly oblong, ca. 1 mm, deeply emarginate and sagittate on stubby filaments ca. 0.5 mm; staminodia birachiate, densely bearded. Capsule gray, broadly obovoid, ca. 4 mm, planoconvex; placentation marginal; seeds narrowly ovoid to ellipsoid-cylindric, 0.5(0.6–0.7)–0.8 mm, opaque or yellow-farinous.

Moist fine sandy peats or organic sandy clay, Atlantic and Gulf Coastal Plains, from south Georgia and panhandle Florida west across Alabama to eastern Texas. Flowering from late June to October or until frost.

During *Xyris*-related fieldwork in the late 1950s and early 1960s, I encountered what then appeared to be two forms of *X. ambigua* Beyrich ex Kunth growing in mixed populations in the flatwoods and savannas of the Gulf Coastal Plain in Mississippi, Louisiana, and eastern Texas. One, a taller plant with more spreading, linear-gladiate leaves of a yellow-green color and with tan or brown bases, had broadly obovate petal blades unfolding in early morning that were nearly 1 cm long. The other form was a shorter plant, with narrower, more ascending leaves red or purplish-tinged at base, and its blooms, opening later in the morning, were broadly obtriangular and only 4–5 mm long. Yet, in my treatment (Kral, 1966: 230) I still treated the two as forms of *X. ambigua*.

During fieldwork in Alabama in the 1970s, I again saw the same variation, noting that, in reddish pigmentation, in corolla size and shape, and particularly in the farinose and narrower seed, affinities of this smaller plant with smaller flowers

actually were more with *Xyris stricta*, a plant often in the same general areas but much more robust and in much wetter habitats. In the 1980s I began using the herbarium name "X. obscura" with colleagues and assigned this nomen nudum to material sent to me for identification. Concomitantly, two other biologists published this plant as *X. louisianica* Bridges & Orzell (1987).

Xyris ambigua and the two proposed varieties of *X. stricta* are compared in Table 3; the three taxa are illustrated in Figures 7, 8, and 9. By its morphology, *X. ambigua* is clearly distinguished. There is considerable character overlap between the two *X. stricta* varieties: these differences are consistently quantitative but at the varietal level.

It is perhaps unusual for the two varieties in *Xyris stricta* to have such different habitats. *Xyris stricta* var. *obscura* always appears upslope or in drier habitat than *X. stricta* var. *stricta*, and thus invariably shares its habitat with *X. ambigua*.

Both varieties nest well within the geographic range of *Xyris ambigua*, which is found on moist sandy or peaty sites in flatwoods, seeps, bogs, and moist open areas of Coastal Plain from Virginia to south Florida, west into eastern Texas, inland to Oklahoma, Arkansas, middle Tennessee, and the Piedmont eastward. It is the only one of the three to be found outside the United States, occurring in the Antilles, Mexico, and Central America. *Xyris stricta* var. *stricta* is found in acid swamps, deep wet bogs, edges of *Taxodium ascendens* Brongniart–*Ilex myrtifolia* Walter–*Nyssa biflora* Walter domes, wet savannas, and flatwoods potholes, mostly on peat-muck substrates, from Louisiana east to northern Florida, north in the South Carolina Coastal Plain. Intermediate examples between *X. stricta* var. *stricta* and variety *obscura* are to be found in ecotonal and disturbed sites in southern Georgia, at or near the eastern boundary of the latter.

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A New Species of *Paederia* (Rubiaceae) from China

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ABSTRACT. The new species *Paederia spectatissima* H. Li from southeastern Yunnan, China, one of few evergreen species in the genus, is here validly published.

During study of the Rubiaceae for the Flora of Yunnan Province, China, the following new species was discovered. An English description, distribution map, list of specimens, and discussion of this species were provided by Puff (1991: 285); the elements necessary for its valid publication and additional notes on its distribution and recognition are provided below.

Paederia spectatissima H. Li, sp. nov. TYPE: China. Yunnan: Xichou Xian, Ting-Mann, alt. 1200–1300 m, in mixed forest, 11 Oct. 1947, *K. M. Feng 12341* (holotype, KUN; isotypes, KUN).

Haec species a *Paederia verticllata* Blume foliis oppositis, inflorescentiae axibus dense albo-scabridis atque fructibus diametro 10–11 mm distinguitur.

Distribution and habitat. Endemic to southeastern Yunnan (Pingien, Xichou, and Malipo), in secondary valley forests and shrubby grasslands at 1200–1300 m.

Paederia spectatissima is similar to *P. verticillata* Blume; *P. spectatissima* can be distinguished by its opposite leaves, axillary inflorescences, and larger fruits 10–11 mm in diameter.

Paratypes. CHINA. **Yunnan:** Pingpien Xian, Ma-Wei village, 1250 m, 17 Oct. 1954, *Feng 5070* (KUN); Malipo Xian, Moun-Cao-ping, 1250 m, in shrubs, grasslands, *Wenshan Group w660–0245* (KUN 2 sheets).

Acknowledgments. I am grateful to C. M. Taylor and Guanghua Zhu for their help with preparation of the manuscript.

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A New Species of *Peritassa* Miers (Hippocrateaceae) from Southern Brazil, and Notes on Two Confused Species

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ABSTRACT. *Peritassa hatschbachii*, a new species of Hippocrateaceae from southern Brazil, is described and illustrated. In addition, comments on two other confused species, *P. calypsoides* and *P. mexiae*, and a key for identification of *Peritassa* species from southern Brazil are provided. A lectotype is proposed for *P. calypsoides*, and complete synonymy is presented.

In the initial phase of a taxonomic study of the neotropical species of Hippocrateaceae, we noticed a confused interpretation of three southern Brazilian taxa of *Peritassa*: *Peritassa calypsoides* (Cambessèdes) A. C. Smith, *P. mexiae* A. C. Smith, and *P. hatschbachii* sp. nov. These three species have a long history of mistaken interpretation, dating back to the original description of *Salacia calypsoides* by Cambessèdes (1829), the basionym of the first of these species. The Muséum National d'Histoire Naturelle in Paris (P) houses two sheets bearing the name *Salacia calypsoides*, the first consisting of two branches, the right branch with a fixed label numbered 129 and the left branch without a label, herbarium label reading "Salacia calypsoides Cambess., Brésil—Province de Rio de Janeiro. Voyage d'Auguste de Saint-Hilaire, de 1816 à 1821. Catal B² n° 129" (F Neg. 35941). The second sheet has one branch and also a fixed label numbered 129, herbarium label reading "4. Salacia calypsoides" and another reading "Isotype." The sheet with two branches is a mixed collection, the left branch corresponding to *S. calypsoides*, and the right to *Peritassa mexiae* A. C. Smith; there is also a duplicate fragment in the Field Herbarium (F 935829) with two leaves, one from each branch on the original sheet. The second sheet at Paris, also corresponding to *S. calypsoides* and described by Cambessèdes (1829: 107) under the number 4, is proposed here as the lectotype of *Salacia calypsoides*.

Martius (1837) proposed the name *Calypso sylvestris*, based on a specimen that he had collected in Rio de Janeiro, that is clearly conspecific with *Salacia calypsoides*, though the leaves are larger and more elliptic (F Neg. 23267) than the lectotype.

Salacia calypsoides is the basionym of *Raddia calypsoides* (Cambessèdes) Miers, a name established by Miers (1872) without study of the original material in Paris. Miers also described *Clercia clusiifolia* Miers, conspecific with *S. calypsoides*, based on a plant collected by Gomez in Rio de Janeiro and currently deposited at K, as well as *Clercia retusa* Miers, also conspecific with *S. calypsoides*, based on a specimen collected by Sellow (without locality) and also currently at K.

Miers transferred *Calypso sylvestris* to his genus *Sarcocampsa*, as *Sarcocampsa silvestris* (Martius) Miers, but the single specimen he examined, collected in Rio de Janeiro by his son, is conspecific with *Peritassa mexiae*.

The last author who treated these taxa was Smith (1940), who established the name *Peritassa calypsoides* (Cambessèdes) A. C. Smith without having seen either the Cambessèdes or Martius types aside from the photographs from the Field Negative Collection. Smith's morphological description of this species is based on the specimens collected by Sellow, and on other specimens collected in the states of São Paulo, Paraná, and Rio Grande do Sul. However, the taxon thus described as *Peritassa calypsoides* by Smith is another species: *Peritassa hatschbachii*, here described.

Smith transferred *Clercia retusa* Miers to the genus *Peritassa*, as *Peritassa retusa* (Miers) A. C. Smith, here considered to be conspecific with *P. calypsoides*. He also described *Peritassa mexiae* A. C. Smith, which corresponds to the circumscription of *Sarcocampsa silvestris* by Miers (1872).

Peritassa calypsoides, *P. hatschbachii*, and *P. mexiae* are easily distinguished by leaf shape and consistency in the dry state, and the size of the inflorescences, even without reference to the characteristics of the flowers (Figs. 1, 2) and the geographic distributions.

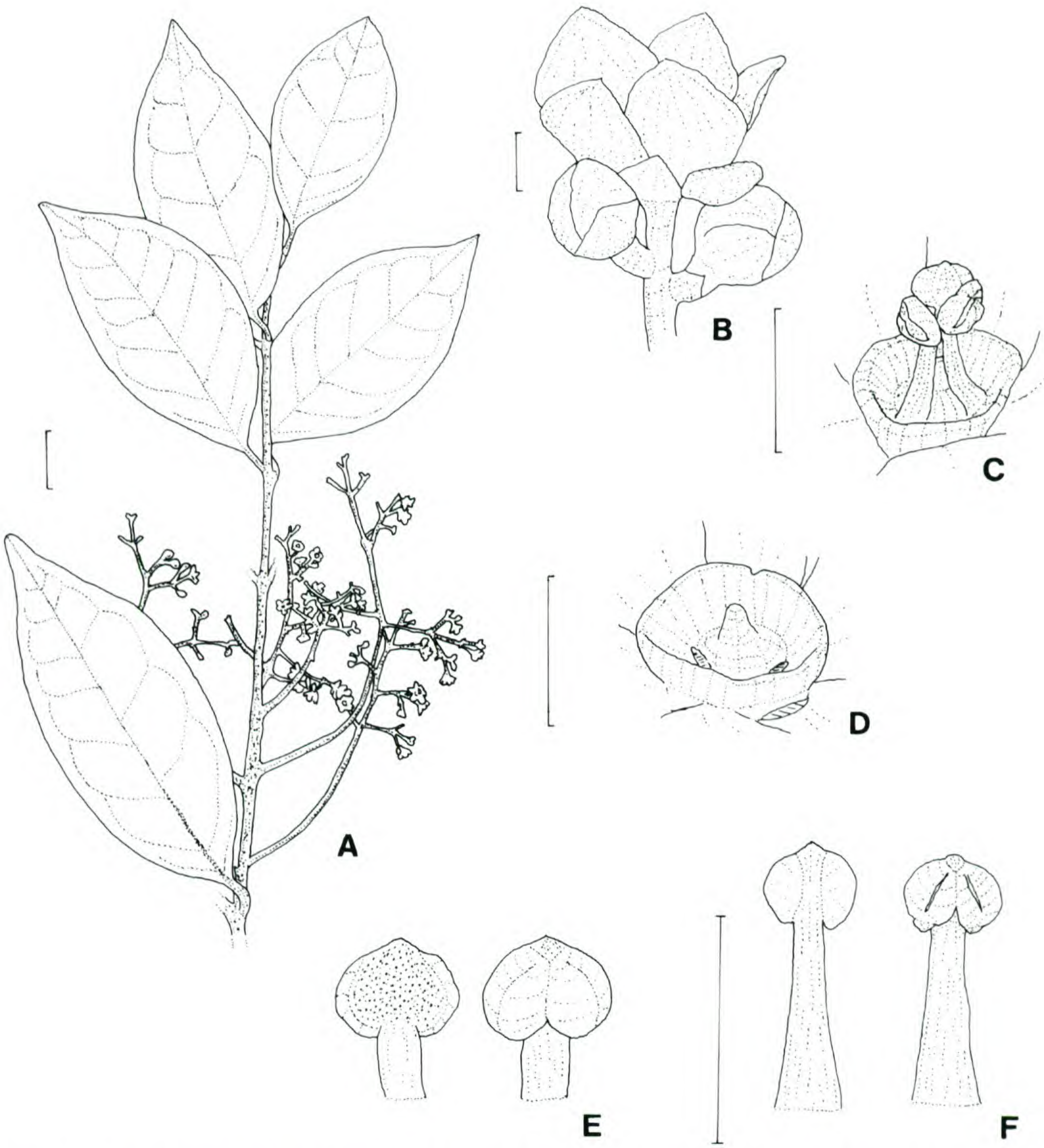

Figure 1. *Peritassa hatschbachii* Lombardi. —A. Branch aspect. —B. Lateral view of flower and buds. —C. Disc, androecium, and gynoecium, petals removed. —D. Disc and gynoecium, petals and stamens removed. —E. Abaxial and adaxial view of young stamen before anthesis. —F. Abaxial and adaxial view of stamen at anthesis. Scales: A = 1 cm, B–F = 1 mm. Drawings by J. A. Lombardi, based on *Ribas 983*.

Peritassa hatschbachii Lombardi, sp. nov. TYPE: Brazil. Paraná: São José dos Pinhais, Rio Arraial, 26 Jan. 1983, *Hatschbach 46068* (holotype, MBM; isotypes, BM, CTES, MO, S, U not seen). Figure 1.

Haec species a *Peritassa calypsoide* inflorescentiis longioribus, staminibus non reflexis, dehiscentia quasi verticali, filamentis longioribus, a *P. laevigata* antherarum connectivis non insigniter productis, et a *P. mexiae* antherarum dehiscentia e positione differt.

Liana, glabrous, drying dark brown, branches terete, lenticellate, fissured, smooth, with seasonal growth marked by scale-like cataphylls. Leaves opposite, stipules 0.4–1.0 mm long, caducous, triangular, apiculate, entire or minutely erose; petiole 0.25–1.0 cm, subcylindric or canaliculate, fissured when dry; blade 2.9–13.6 × 1.1–7.5 cm, elliptic, chartaceous, the base cuneate, the apex acute and sometimes slightly emarginate, the margin entire or obscurely denticulate and thickened, often cream-

colored when dry, venation brochidodromous with veins prominulous on both sides. Inflorescence thyrsoid-paniculate, 0.9–6.3(–7.8) × (0.45–)1.3–5.2(–7.2) cm, with 10–180 flowers, axillary, often at leafless nodes; bracts 0.6–1.0 mm long, triangular, the margin entire, scarious; peduncle 0.2–3.4(–4.1) cm long, minutely lenticellate-punctulate, subcylindric to flattened; branches alternate or subopposite; pedicels 0.4–0.9 mm long, cylindric, articulate at base; bracteoles 2, at base of pedicel, triangular, 0.3–0.5 mm long. Flowers yellowish, (3.1–)3.5–4.4 mm wide at anthesis; sepals 5, 0.6–1.5 × 0.8–1.5 mm, elliptic, unequal, ± carnose, the margin entire, drying revolute; petals 5, 1.9–3.1 × 1.3–2.1 mm, obovate, ± carnose, ± ascending at anthesis, the margin minutely erose, scarious, plicate; disc short-tubular, slightly projecting, ca. 0.4 mm high, carnose, free from reproductive parts, the margin sinuate; stamens 3, ca. 1 mm long, in open flower appressed to gynoecium, the filaments flattened, slightly enlarged at base, the connective adaxially thickened, not surpassing the thecae or slightly so, drying brown, the anthers oblong, ca. 0.3 × 0.3 mm, slightly emarginate at base, basifixed, composed of two extrorse locules, dehiscing longitudinally by oblique slits slightly divergent at base; ovary slightly 3-lobed, 3-locular, with 2 subapical ovules at each locule, style ca. 0.25 mm long, central, cylindric; stigmas obscure. Mature drupe ca. 3.8 × 3.6 cm, subspherical, tuberculate, drying glaucescent or brown; seeds 2.3–3.4 × 1.1 × 0.9–1 cm, subreniform, triangular in section, testa smooth, firmly embedded in juicy endocarp, drying brown.

Vernacular. Bacupari-de-cipó, Fruta-de-macaco.

Peritassa hatschbachii occurs at altitudes of 20–900 m in rainforests of the southern Brazilian Atlantic coast, to as far north as southern Rio de Janeiro in mountain forests in the Serra dos Orgãos. This species can easily be distinguished from *Peritassa calypsoides* by the larger flowers, the stamens not reflexed with longer filaments, the position of the dehiscence slits, the larger inflorescences, and by the consistently elliptic leaves with an acute apex. It can be distinguished from *Peritassa laevigata*, which is similar in leaf form and inflorescence size, by the connective not conspicuously exceeding the anther thecae, by the slightly oblique dehiscence of the anthers, and by the smaller mature fruits.

Paratypes. BRAZIL. **Paraná:** Ypiranga, 22 Mar. 1909, *Dusén 8311* (S); Fortaleza, 26 Feb. 1910, *Dusén 9561* (F, GH, L, MICH, S); Jaguariahyva, 3 Nov. 1910, *Dusén 10305* (GH, S); Volta Grande, 7 Aug. 1911, *Dusén 12023* (S); Volta Grande, 17 Aug. 1911, *Dusén 12056* (GH, S); Ypiranga, 28 Aug. 1911, *Dusén 12094* (S); Carvalho, 13 Sep. 1911, *Dusén 13000* (S); without locality, 1903, *Dusén s.n.* (S); Morretes, 3 Aug. 1975, *Dziewa 15* (MBM); Guaratuba, Serra de Araçatuba, 31 Jan. 1960, *Hatschbach 6712* (HB, L, MBM); Morretes, Grota Funda, estrada da Graciosa, 12 Jan. 1964, *Hatschbach 10836* (BHCB, HB, MBM); Quatro Barras, Cerne, 23 Feb. 1964, *Hatschbach 10990* (MBM); Rio Branco do Sul, Serra do Caete, 10 Jan. 1978, *Hatschbach 40694* (UB); Morretes, Marumbi, 4 Jan. 1979, *Hatschbach 41837* (F, MBM); Morretes, Rio Bromado, 12 Feb. 1985, *Hatschbach 48899 & Zelma* (MBM, S); Guaraqueçaba, caminho do Paruquara, 23 Jan. 1991, *Hatschbach 54897 et al.* (CTES, HUEFS, MBM, W); Morretes, Manduíra, 1 Feb. 1996, *J. M. Silva 1633 & Ribas* (BHCB, MBM). **Rio de Janeiro:** Petrópolis, Meio da Serra, Serra da Estrela, 9 Mar. 1978, *Martinelli 4034* (RB). **Rio Grande do Sul:** prope Porto Alegre, Canoas, 10 Nov. 1892, *Malme 290b* (S). **Santa Catarina:** Florianópolis, Morro do Ribeirão, 14 Feb. 1967, *R. M. Klein 7159* (MBM); Florianópolis, Bom Retiro, Paulo Lopes, 19 Feb. 1973, *R. M. Klein & Bresolin 10846* (P); Florianópolis, Morro Costa da Lagoa, 22 June 1967, *R. M. Klein & Souza Sobrinho 7482* (MBM); Itajaí, Morro da Fazenda, 3 June 1954, *Reitz & R. M. Klein 1863* (B, HB, L); Campo Alegre, Morro do Iquererim, 9 Jan. 1958, *Reitz & R. M. Klein 6021* (S); Presidente Nereu, Sabiá, 29 Jan. 1958, *Reitz & R. M. Klein 6364* (B, HB, L); Campo Alegre, Morro do Iquererim, 4 Feb. 1958, *Reitz & R. M. Klein 6366* (B, GH, L, UC); Rio do Sul, Alto Matador, 16 Apr. 1958, *Reitz & R. M. Klein 8724* (B, F, G, L, UC); Campo Alegre, margens do Rio Negro, 17 Jan. 1996, *Ribas 983 et al.* (BHCB, MBM). **São Paulo:** São Paulo, Parque do Estado, planta viva número 9, 20 Jan. 1932, *Hoehne s.n.* (F 895908, HB 9025); Santos, in ripa annuis Butuvira, 1 Dec. 1874, *Mosén 3039a* (C, S-2), 25 Jan. 1875, *Mosén 3039b* (S-3); Santos, 1875, *Mosén 3039c* (S).

Peritassa calypsoides (Cambessèdes) A. C. Smith, Brittonia 3: 522. 1940. *Salacia calypsoides* Cambessèdes, in A. Saint-Hilaire, A. Jussieu & Cambessèdes, Fl. Bras. Merid. 2: 107. 1829. *Tontelea calypsoides* (Cambessèdes) Endlicher ex Walpers, Repert. Bot. Syst. 1: 400. 1842. *Raddia calypsoides* (Cambessèdes) Miers, Trans. Linn. Soc. London 28: 396. 1872. TYPE: Brazil. Rio de Janeiro: without locality, 1816–1821, *Saint-Hilaire 129* (lectotype, designated here, P [4. Salacia calypsoides]; isolectotype, F 935816).

[Other original material, P [Salacia calypsoides Cambessèdes] not seen (left branch) = F Neg. 35941, F 935829 (elliptic leaf), both specimens mixed in the sheets with *Peritassa mexiae.*]

Calypso sylvestris Martius, Flora 20: 96. 1837. *Salacia sylvestris* (Martius) Steudel, Nomencl. Bot., ed. 2, 2: 492. 1841. *Sarcocampsa silvestris* (Martius) Miers, Trans. Linn. Soc. London 28: 409. 1872. TYPE: Brazil. Rio de Janeiro: "in sylvis ad Lagoa dos Indos,"

Martius Herbar. Florae Brasil. 97 (holotype, G = F Neg. 23267; isotype, W).

Clercia clusiifolia Miers [*clusiaefolia*], Trans. Linn. Soc. London 28: 381. 1872. TYPE: Brazil. Rio de Janeiro: without locality, *Gomez 36* (holotype, K not seen; isotype, BM).

Clercia retusa Miers, Trans. Linn. Soc. London 28: 380. 1872. Syn. nov. *Peritassa retusa* (Miers) A. C. Smith, Brittonia 3: 524. 1940. TYPE: Brazil. Without locality, *Sellow s.n.* (holotype, K not seen; isotype, BM). Figure 2A–D.

Liana, glabrous, drying rusty brown; branches terete to subquadrangular, lenticellate, striate, smooth, with short prehensile lateral branches. Leaves opposite; stipules 0.4–0.6 mm long, triangular, entire, caducous; petioles 0.2–0.6 cm, canaliculate; blade 1.9–7.4(–12.4) × 0.5–5.4 cm, obovate or elliptic, chartaceous, the base attenuate or cuneate, the apex acute or rounded, the margin entire or obscurely crenulate and thickened; venation brochidodromous with veins immersed on both sides or prominulous on abaxial side. Inflorescence thyrsoid-paniculate, 0.6–2.9 × 0.6–3.1 cm, with 15–35 flowers, axillary; bracts 0.4–1.0 mm long, triangular, the margin entire or minutely erose or denticulate, scarious, carnose; peduncles 0–15 mm long, covered by imbricate bracts at least at base, the peduncle and branches minutely lenticellate-punctulate, subcylindric; branches opposite or alternate; pedicels ca. 0.7 mm long, cylindric; bracteoles 2, at base of pedicel, triangular, ca. 0.5 mm. Flowers yellowish, 2.4–2.6 mm wide at anthesis; sepals 5, 0.8–1.2 × 0.8–1.5 mm, triangular or oblong, carnose, the margin entire, scarious; petals 5, 1.4–1.6 × 1.0–1.3 mm, obovate, ± carnose, deflexed at anthesis, the margin entire; disc short-tubular, 0.3–0.4 mm high, carnose, free from reproductive parts, the margin sinuate or entire; stamens 3, ca. 0.6 mm long, in open flower exserted, the filaments flattened, the connective triangular, adaxially slightly thickened at base, not surpassing the thecae, drying brown, the anthers oblong, ca. 0.2 × 0.3 mm, dorsifixed, reflexed, dehiscence extrorse by oblique slits strongly divergent at base in immature stamen, almost vertical in mature stamen; ovary slightly 3-lobed, 3-locular, with 2 subapical ovules in each locule, style ca. 0.15 mm long, central, cylindric; stigma obscure. Mature drupe ca. 5.3 × 3.3 × 3.3 cm, ellipsoid, drying dark brown, minutely pitted; seeds ca. 2.1 × 1 × 0.7 cm, ellipsoid.

Peritassa calypsoides occurs in seashore vegetation for a distance of ca. 140 km between the cities of Rio de Janeiro and Cabo Frio, and in the Atlantic rainforests of southern Bahia. Only the great leaf size of *Martius 97* and the poor condition of the inflorescences made possible the incorrect interpretation of the sheet's photograph by Smith (1940), as this species and *P. hatschbachii* are very distinct and easily distinguished by the size of the flowers and inflorescences, as well as by flower and stamen characteristics. The two specimens examined from southern Bahia have leaves matching those of Martius's specimen in size and also the leaves of *P. hatschbachii.*

Additional specimens seen. BRAZIL. **Bahia:** Uruçuca, nova estrada que liga Uruçuca à Serra Grande, a 28–30 km de Uruçuca, 16 July 1978, *Mori et al. 10253* (RB); Una, estrada Una/São José, ca. 17 km ao W do município sede, 20 July 1994, *Jardim et al. 498* (BHCB, CEPEC). **Rio de Janeiro:** perto de Maricá, Lagoa do Padre, 8 Sep. 1975, *Araújo 764 & Peixoto 570* (BHCB, RB); Maricá, Lagoa do Padre, 8 Sep. 1950, *Bautista 150* (RB-2); Maricá, Barra de Maricá, 5 Mar. 1985, *V. L. G. Klein 261 et al.* (BHCB, RB); Lagoa de Piratininga, 8 Nov. 1922, *Kuhlmann s.n.* (BHCB 34486, RB 20868); Oct. 1832, *Riedel 1084* (P, W); without date, *Riedel s. n.* (W.); Barra de Maricá, 25 Sep. 1978, *Rizzini & Mattos 1036* (CTES); without locality, 1832, *Lhotsky s.n.* (G); Cabo Frio, 13 Oct. 1968, *Sucre 3950* (BHCB, RB).

Peritassa mexiae A. C. Smith, Brittonia 3: 517. 1940. TYPE: Brazil. Minas Gerais: Viçosa, off road to São Miguel, 720 m, 22 Oct. 1930, *Mexia 5206* (holotype, US not seen; isotypes, BM, F = F Neg. 40852, GH). Figure 2E–H.

Liana, glabrous, drying cinereous; branches subterete, lenticellate, striate, smooth, ± glaucous. Leaves opposite or subopposite; stipules ca. 0.7 mm long, caducous, triangular; petioles 0.4–1.1 cm, canaliculate; blade 4.2–19.5 × 1.9–8.8 cm, elliptic or (rarely) almost orbicular, coriaceous, the base cuneate or rounded, the apex acute, the margin entire or obscurely crenulate and thickened, drying minutely pitted on both sides, opaque, venation brochidodromous with veins immersed to plane adaxially, secondary veins prominulous abaxially. Inflorescence thyrsoid-paniculate, (0.8–)2.3–5.0 × (0.8–)2.8–7.1 cm, with 30–200 flowers, axillary, often at leafless nodes; bracts 0.5–1.0 mm long, triangular, denticulate at base, erose, sometimes distant from the ramifications; peduncles 0–6 mm long, striate, cylindric; branches alternate or subopposite; pedicels 1.9–2.5 mm long, cylindric, bracteoles 2, at base of pedicel, triangular, sometimes absent, ca. 0.4 mm long. Flowers yellowish, fragrant, 3.5–4.0 mm wide at anthesis; sepals 5, 0.6–1.4 × 0.7–1.1 mm, elliptic, ± carnose, minutely papillose, cucullate, the margin fimbriolate; petals 5, 1.7–2.1 × 1.0–1.2 mm, elliptic, ± carnose, ± deflexed at anthesis, the margin papillose, plicate; disc annular, short tubular, ca. 0.4 mm high, car-

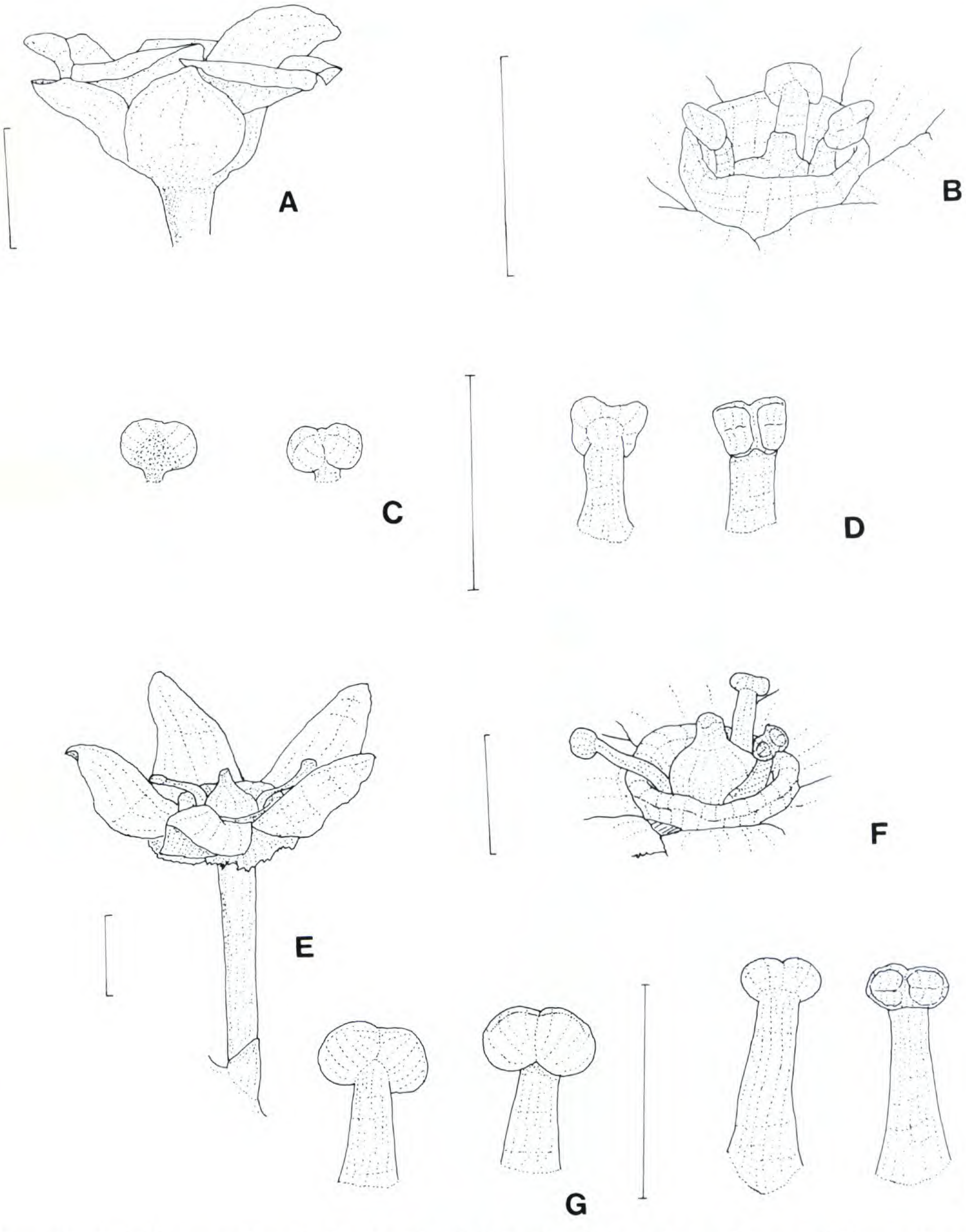

Figure 2. A–D. *Peritassa calypsoides* (Cambessèdes) A. C. Smith. —A. Lateral view of flower. —B. Disc, androecium, and gynoecium, petals removed. —C. Abaxial and adaxial view of young stamen before anthesis. —D. Abaxial and adaxial view of stamen at anthesis. E–H. *Peritassa mexiae* A. C. Smith. —E. Lateral view of flower. —F. Disc, androecium, and gynoecium, petals removed. —G. Abaxial and adaxial view of young stamen before anthesis. —H. Abaxial and adaxial view of stamen at anthesis. Scales: A–H = 1 mm. Drawings by J. A. Lombardi; A–D from *Bautista 150*; E–H from *Lombardi 1305*.

nose, free from reproductive parts, the margin sinuate or entire, projecting, yellow in dry or fresh state; stamens 3, ca. 0.9 mm long, in open flower exserted and reflexed, the filaments flattened, the connective adaxially thickened, not surpassing the thecae, the anthers oblong, ca. 0.15 × 0.4 mm, slightly emarginate in base and apex, basifixed, dehiscence extrorse by very strongly almost horizontal

divergent apical slits; ovary slightly 3-lobed, 3-locular, with 1 subapical ovule in each locule, style ca. 0.3 mm long, central, cylindric; stigmas obscure, yellow in dry and fresh state. Mature drupes not seen, immature 0.9–1.3 × 0.6–1.1 × 0.5–1.0 cm, subspherical, the epicarp apparently thin, drying blackish to glaucescent; seeds fusiform, 1–3.

This species is restricted to rainforests of the Atlantic coast of Brazil and inland to the State Park of Rio Doce in Minas Gerais. It is easily distinguished from *P. calypsoides* and *P. hatschbachii* by the leaves drying cinereous, the long-pedicelled flowers, the spreading petals, and by the noteworthy almost horizontal dehiscence of the anthers.

Additional specimens seen. BRAZIL. **Espírito Santo:** Linhares, canal da Lagoa Juparanã, 13 Aug. 1965, *Belém 1584* (UB). **Minas Gerais:** Caratinga, Estação Biológica de Caratinga, 20 June 1988, *Costa et al. 524* (BHCB), 30 Sep. 1995, *Gomes 285* (BHCB); Marliéria, Parque Estadual do Rio Doce, 16 July 1993, *Lombardi 351* (BHCB, SPF); Marliéria, Parque Estadual do Rio Doce, margens da Lagoa da Barra, 17 July 1996, *Lombardi 1305* (BHCB, ESA, MBM, SPF). **Rio de Janeiro:** Rio de Janeiro, Corcovado, 4 Aug. 1959, *Duarte 4950* (HB, RB [as 10 Oct. 1942]); without locality, *Saint-Hilaire 129a* (P not seen = F Neg. 35941 [right branch], F 935829 [orbicular leaf]); Iguassu, "Sarcocampsa silvestris," *Miers s.n.* (BM).

Key to the Species of *Peritassa* in Southern Brazil

1a. Shrubs, in cerrado and rocky grasslands . . . . . *P. campestris* (Cambessèdes) A. C. Smith
1b. Lianas, shrubs, or trees, in forests and seashore vegetation.
2a. Connective apiculate and exceeding thecae.
3a. Petals 0.8–1.3 mm long, pedicel 1.0–1.5 mm long, leaf margin conspicuously crenulate, inflorescence (0.7–)1.1–2.4 cm long, with ca. 25–50 flowers [Minas Gerais, Rio de Janeiro, São Paulo] . . . . . *P. flaviflora* A. C. Smith
3b. Petals 2.3–3.3 mm long, pedicel (1.3–)2.1–3.7 mm long, leaf margin entire or crenulate, inflorescence (0.7–)2.0–5.3(–9.5) cm long, with ca. 30–200 flowers [Espírito Santo, Rio de Janeiro] . . . . . *P. laevigata* (Hoffmannsegg ex Link) A. C. Smith
2b. Connective not or only slightly exceeding thecae.
4a. Filaments conspicuously exceeding border of disc.
5a. Anther locules dehiscing by slightly divergent slits; ovary locules consistently with two ovules . . . . . *P. hatschbachii*
5b. Anther locules dehiscing by very strongly divergent slits, almost apical; ovary locules consistently with one ovule . . . . . *P. mexiae*
4b. Filaments not exceeding the border of disc . . . . . *P. calypsoides*

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Una Nueva Especie de *Acaena* (Rosaceae) en Sudamérica Austral

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RESUMEN. Se describe una nueva especie de *Acaena*, *A. patagonica*, de la zona patagónica de Chile y Argentina. Se publica además una nueva sección dentro del género la que incluye a esta especie.

ABSTRACT. A new species of *Acaena*, *A. patagonica*, from Patagonian Chile and Argentina, is described. A new section of the genus is erected to include this species.

El género *Acaena* Mutis ex L. posee alrededor de 100 especies (Mabberley, 1987) con una mayor distribución en el hemisferio sur, presentando sólo pocas especies en el hemisferio norte, por ejemplo México, California, Hawaii (Hutchinson, 1967). En Chile el género posee 20 especies (A. Marticorena, in prep.) y en Argentina unas 21 especies (Grondona, 1964, 1984), la mayoría de la zona austral.

El género se divide en secciones basado en el tipo de inflorescencia y características de la cupela. La cupela corresponde al conjunto del tálamo acrescente y el aquenio protegido por el tálamo. Sin embargo, la nueva especie no presenta ninguna de las combinaciones de caracteres de las secciones existentes que permita incluirla en ellas, luego se propone una nueva sección.

Acaena secc. **Patagonicae** A. Marticorena, sect. nov. TIPO: *Acaena patagonica* A. Marticorena.

Inflorescentia terminalis spiciformis; fructus cupula ovata, glabra vel pubescente, 3–4-costata, apice costa aculeo solitario disposita, sine glochidibus; folia sine stipulis.

Inflorescencia espiciforme corta, alargada en estado fructfero, con glomérulos dispersos a lo largo del pedúnculo. Cupela ovoide, glabra a pilosa, con 3–4 espinas apicales, sin gloquidios. Hojas sin estípulas.

Acaena patagonica A. Marticorena, sp. nov. TIPO: Chile. Ultima Esperanza: Parque Nacional Torres del Paine, Cerro Diente, 900 m, 15.XII.1985, *Arroyo & Squeo 850829* (holótipo, CONC). Figura 1.

Planta perennis, caulibus brevissimis. Folia ambitu linearia, 1.3–2.5 cm longa; foliolis 5–8-jugis, 3.0–6.5 mm longis, obovatis vel obovato-orbicularibus, base cuneiformibus, 3–5-partitis, laciniis linearibus, margine revolutis, superne glabrescentibus, inferne sericeis; vagina margine trichomatibus unicellularibus longis vestita; sine stipulis. Inflorescentia terminalis spiciformis pauciflora diametro ca. 6.5 mm; ramo florifero terminali in pedunculum usque ad 16 cm longum desinente; bracteis basalibus linearibus vel triangularibus, 1.0–1.5 mm longis, margine partitis. Flos sepalis 4–5, lanceolatis, ca. 1.5 mm longis, supra glabris, infra sericeis, apice trichomatibus floccosis ornatis; staminibus 4, antheris orbicularibus, ca. 0.3 mm longis; stigmate rotundato, laciniato, ca. 0.5 mm diametro. Fructus cupula ovata vel rotundata, 1.5–2.5 mm longa, pubescente vel glabra, 3–4-costata, quaque costa aculeo solitario 0.5–2.0 mm longo, trichomatibus retrorsis tecto apice ornato, raro aculeo brevi rudimentario sub aculeo apicali posito; achenio solitario.

Planta de hasta 20 cm de alto, con entrenudos cortos. Hojas en contorno lineares, lámina 1.3–2.5 cm de largo; folíolos 5–8 pares, 3.0–6.5 mm de largo, obovados a obovado-orbiculares, 3–5-partidos, los segmentos lineares a linear-lanceolados, el margen revoluto, el haz glabrescente, con tricomas blancos esparcidos, el envés seríceo, la base cuneada; vainas foliares con el margen con pelos largos, apéndices estipulares ausentes. Rama florífera terminal; pedúnculos hasta 16 cm de largo, pubescentes a seríceos; inflorescencia espiciforme corta, ca. 6.5 mm de diámetro, con pequeños glomérulos de flores y/o frutos a lo largo del pedúnculo; brácteas basales lineares a triangulares, 1.0–1.5 mm de largo, el margen partido. Flor chasmógama con 4–5 sépalos lanceolados, ca. 1.5 mm de largo, internamente glabros, externamente seríceos, tricomas en el ápice; estambres 4, las anteras orbiculares, ca. 0.3 mm de largo; estigma orbicular, laciniado, ca. 0.5 mm de diámetro. Cupela ovada a casi redonda, 1.5–2.5 mm de diámetro, pubescente a glabra, con 3–4 costillas, cada costilla con una espina de 0.5–2.0 mm de largo, con tricomas retrorsos desde el ápice, dispuestas en el tercio superior de la cupela, a veces con otra espina rudimentaria bajo la principal; aquenio 1.

Distribución y habitat. Esta especie habita en la zona de las Torres del Paine (Ultima Esperanza) y en el Estrecho de Magallanes, Chile, y al sur de la provincia de Santa Cruz y Tierra del Fuego, Argentina. Crece entre rocas, en sitios secos y también en vegas de altura, desde el nivel del mar hasta los 1030 m.

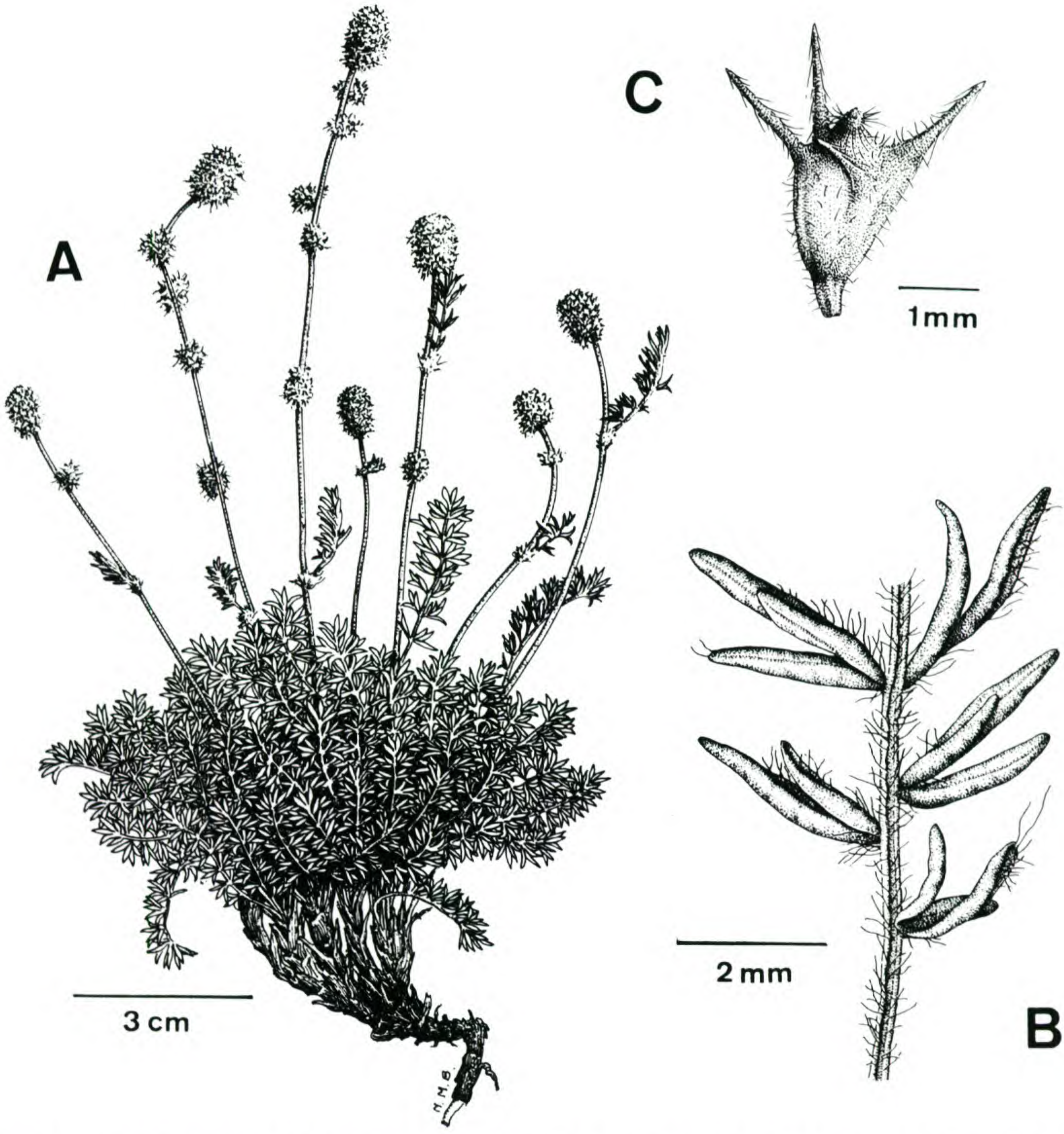

Figura 1. *Acaena patagonica* A. Marticorena. —A. Planta. —B. Hoja y detalle de los folíolos. —C. Cupela. (A, B basado en *Arroyo & Squeo 870189*; C basado en *Elvebakk 532*.)

Esta especie es afin a *A. pinnatifida* Ruiz & Pavón, *A. platyacantha* Speg. y *A. poeppigiana* Gay. De *A. pinnatifida* se diferencia por ser más pequeña y frágil, con folíolos menos divididos y las cupelas con 3–4 espinas apicales; de *A. platyacantha* por los folíolos más finos, menos pilosos, cupela sin costillas notorias, espinas no aladas y superficie de la cupela lisa, la que generalmente es rugosa en aquella especie; y de *A. poeppigiana* por presentar folíolos lineares y cupela sin espinas pequeñas entre las costillas o bajo la espina apical. Otro carácter que reafirma el reconocimiento de esta especie y de la sección, es el patrón que presenta la epidermis de la cupela. Originalmente el género se divide en secciones, las que estan delimitadas por el tipo de inflorescencia y características de la cupela (Bitter, 1911). Según el tipo de inflorescencia de *Acaena patagonica*, esta debería incluirse en la sección *Acaena*. Sin embargo, las características de la cupela son diferentes al resto de las de la sección y se asemejan a las de la sección *Acrobyssinoideae*, por el número de espinas y su posición. Las especies afines antes mencionadas pertenecen a la sección *Acaena*, basada en caracteres macroscópicos, las que además comparten caracteres microscópicos que tienen relación con el tipo de células

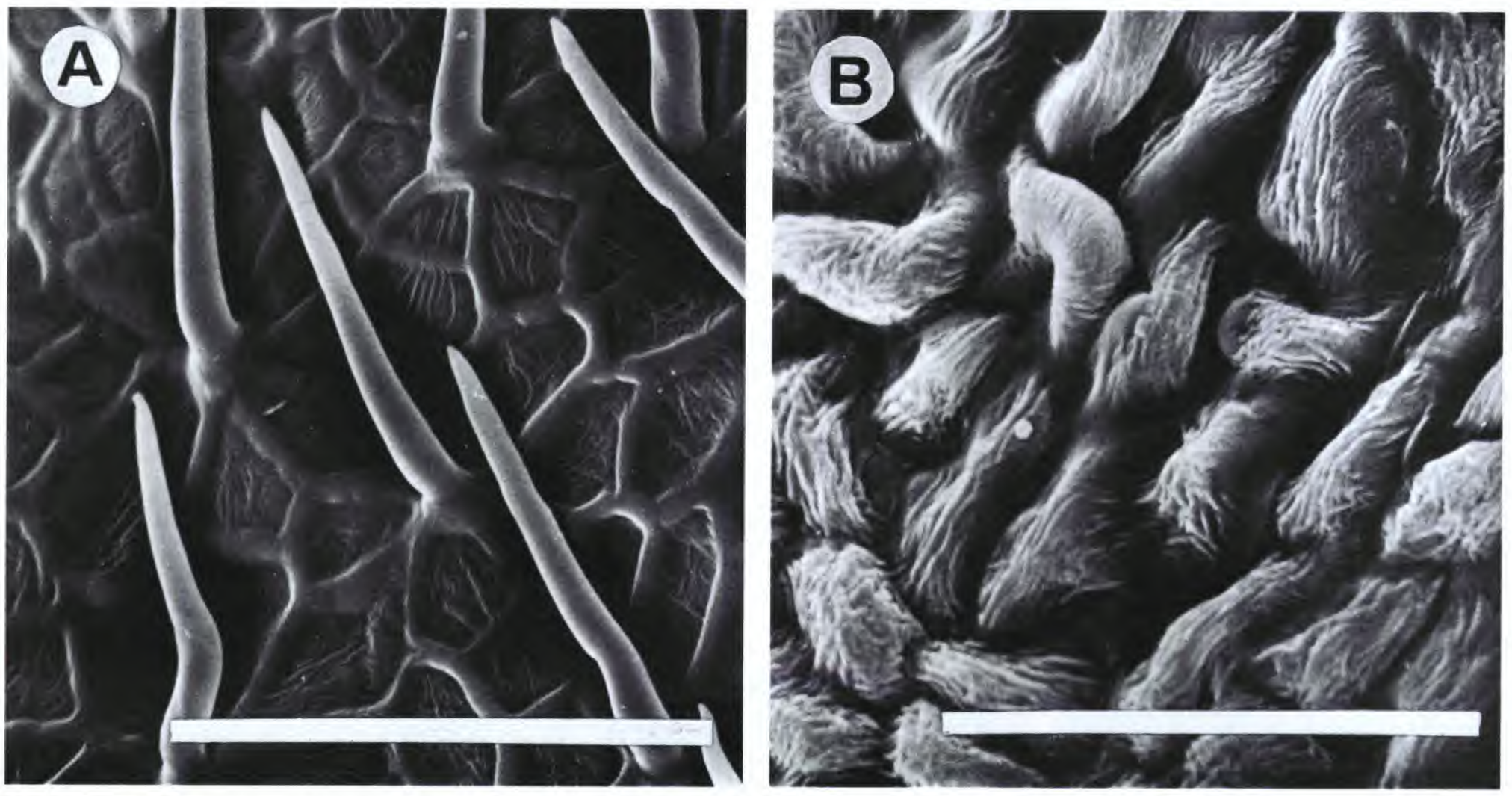

Figura 2. Células epidérmicas de la cupela. —A. Tipo celular de la sección *Acaena*. —B. Células de *A. patagonica*. Escala: 100 μm.

de la epidermis de la cupela, los que discriminan claramente y agrupan a las demás especies de la sección que crecen en Chile (A. Marticorena, in prep.). El tipo celular de las especies que pertenecen a la sección *Acaena* corresponde a células más o menos isodiamétricas, con paredes anticlinales rectas y relieve celular levantado (Fig. 2A), en tanto que las células de *A. patagonica* no presentan límites definidos, las paredes anticlinales son irregulares y sinuosas y el relieve celular es acanalado (Fig. 2B). Los caracteres de la cupela son los que entregan mayor información y por lo tanto son de gran utilidad para la determinación de las especies y delimitación de las secciones.

Clave para *A. patagonica* y Especies Relacionadas

1a. Plantas mayores de 50 cm de alto; folíolos 5–7-partidos; cupela con espinas de tamaño similar . . . . . *A. pinnatifida*
1b. Plantas menores de 30 cm de alto; folíolos 2–5-partidos; cupelas con espinas mayores en el tercio superior.
  2a. Segmentos de los folíolos ovados; cupela con espinas pequeñas entre las costillas o pequeñas espinas triangulares bajo la espina principal . . . . . *A. poeppigiana*
  2b. Segmentos de los folíolos lineares; cupela sin espinas pequeñas entre las costillas.
    3a. Folíolos pubescentes a seríceos; superficie rugosa entre las costillas de la cupela; espinas triangulares, aplastadas lateralmente . . . . . *A. platyacantha*
    3b. Folíolos glabros a glabrescentes; superficie lisa entre las costillas de la cupela; espinas aciculares . . . . . *A. patagonica*

Paratipos. ARGENTINA. **Santa Cruz:** Güer Aike, Estancia Las Viscachas, cono Pan de Azúcar, 50°45′S, 71°58′O, 1030 m, 28 ene. 1977, *T.B.P.A. 2563* (HIP); Estancia La Verdadera Argentina, S Cerro León, 50°53′S, 72°13′O, 16 ene. 1977, *T.B.P.A. 2052* (HIP); Estancia Cabo Buen Tiempo, 51°35′S, 69°07′O, 4 dic. 1975, *T.B.P.A. 50* (HIP). **Tierra del Fuego:** Tennessse oil camp, 11 dic. 1965, *Goodall 207* (LP). CHILE. **Prov. Ultima Esperanza:** Estancia Dos de Enero, Valle de las Chinas, 8 dic. 1978, *Pisano & Cárdenas 4853* (HIP); Sierra Baguales, cerro Santa Lucía, 50°44′S, 72°20′O, 800 m, 2 feb. 1987, *Arroyo & Squeo 870189* (CONC); Cerro Donoso, Río de las Chinas, 50°44′S, 72°31′O, 70 m, 9 feb. 1987, *Arroyo, Veloso & Peñaloza 870265* (CONC); Cerro Corona, La Victorina, Lago Paine, 50°48′S, 72°47′O, 500 m, 21 feb. 1982, *Pisano 5631* (HIP); 4–5 km SE Estancia Guido, 50°55′S, 72°20′O, 150 m, 9 dic. 1995, *Elvebakk 532* (CONC). **Prov. Magallanes:** Punta Delgada, Buque Quemado, 52°28′S, 69°32′O, 5 m, 3 dic. 1978, *Dollenz 495, 497* (HIP).

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New Boraginaceae from Tropical America 1: New Species of *Bourreria* and *Tournefortia* from Costa Rica and a Note on the Publication of *Cordia collococca*

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ABSTRACT. *Bourreria rinconensis* and *Tournefortia isabellina* are described as new from Costa Rica. Keys are provided to the Costa Rican species of *Bourreria* and the Central American species of *Tournefortia* sect. *Cyphocema*.

In preparing a treatment of Boraginaceae for *A Manual to the Plants of Costa Rica*, two collections representing previously undescribed taxa were discovered.

Bourreria rinconensis J. S. Miller, sp. nov. TYPE: Costa Rica. Puntarenas: Cantón de Osa, Aguabuena, margen izquierda de Quebrada El Campo, Rincón, 8°42′45″N, 83°31′35″W, elev. 200 m, 22 Sep. 1990, *Gerardo Herrera 4350* (holotype, MO 04660635). Figure 1.

Arbor usque ad 8 m alta. Folia persistentia; lamina glabra, elliptica, 7.7–14 cm longa, 2.7–6 cm lata, apice acuminata, basi acuta ad attenuata; petiolo 1.3–2.3 cm longo, glabro. Inflorescentia terminalis, cymosa; pedunculo 12–18 mm longo, glabro. Flos gemmis 8–9 mm longis, apiculatis; calyce 6.5–8 mm longo, extus glabro, intus strigoso; corolla alba, hypocrateriformi, ca. 16 mm longa, 5-loba, lobulis late ovatis, 3–3.5 mm longis, ca. 3 mm latis; staminibus 5, filamentis ca. 14 mm longis, ad insertionem puberulis. Fructus non visi.

Tree 8 m tall, the bark corky, the twigs glabrous. Leaves persistent; leaf blades elliptic, 7.7–14 cm long, 2.7–6 cm wide, the apex acuminate, the base acute to attenuate, the margin entire, the adaxial surface glabrous, lustrous, the abaxial surface glabrous, the venation brochidodromous, the midrib prominent, strongly impressed above, raised below, the secondary veins arching, 6–8; petioles 1.3–2.3 cm long, broadly canaliculate on the adaxial surface, glabrous. Inflorescences terminal, cymose, the peduncles 12–18 mm long, glabrous. Flowers bisexual, the buds ellipsoid, 8–9 mm long, apiculate; calyx leathery, tubular, 6.5–8 mm long, ca. 3 mm wide at the mouth, glabrous, 5-lobed, the lobes sometimes not separating completely and the calyx appearing 2–4-lobed, triangular, 3–5 mm long, 1.5–2 mm wide at the base, the interior surface of the lobes densely strigose. Corolla white, salverform, brown tomentulose, the tube ca. 16 mm long, 2.5–3 mm wide at the mouth, the 5 lobes spreading, widely ovate, 3–3.5 mm long, ca. 3 mm wide, the apex obtuse to rounded; stamens 5, the filaments ca. 14 mm long, the upper 8 mm free, puberulent at and just beneath the point of insertion; ovary ovoid, ca. 1.5 mm tall, 1 mm broad, glabrous, the style ca. 9 mm long, the 2 stigmas capitate. Fruit unknown.

Bourreria rinconensis is known only from the type collected in lowland wet forest on the Osa Peninsula.

Bourreria is a complex genus with questionable generic boundaries (Thulin, 1987; Miller, 1989), and there is no comprehensive treatment of the species available. The approximately 50 species have been considered by most authors to be restricted to the New World, occurring in the Caribbean and adjacent south Florida, Mexico and Central America, and northern South America. Thulin (1987) extended both the morphological and geographic boundaries of the genus by including five species of *Ehretia* L. from eastern Africa. The Central American species seem to form two natural groups, one with large corollas and leathery tubular calyces (e.g., *B. grandicalyx* J. S. Miller & Sirot and related species) and the other with smaller corollas and small, membranaceous, campanulate calyces (e.g., *B. andrieuxii* (A. DC.) Hemsley, *B. mollis* Standley, and *B. oxyphylla* Standley). *Bourreria rinconensis* is a member of the group of species with large corollas and leathery tubular calyces that was treated recently by Miller and Sirot (1997). Within this group, *B. rinconensis* shares a narrow salverform corolla with a narrow, nearly parallel-sided tube with *B. quirosii* Standley and *B. cumanensis* (Loefling) O. E. Schulz. *Bourreria cumanensis* occurs along the north coast of South America and differs in having shorter, broader leaves and a much smaller corolla. *Bourreria quirosii* occurs in dry forests in Guanacaste, Costa Rica, and Nicaragua and dif-

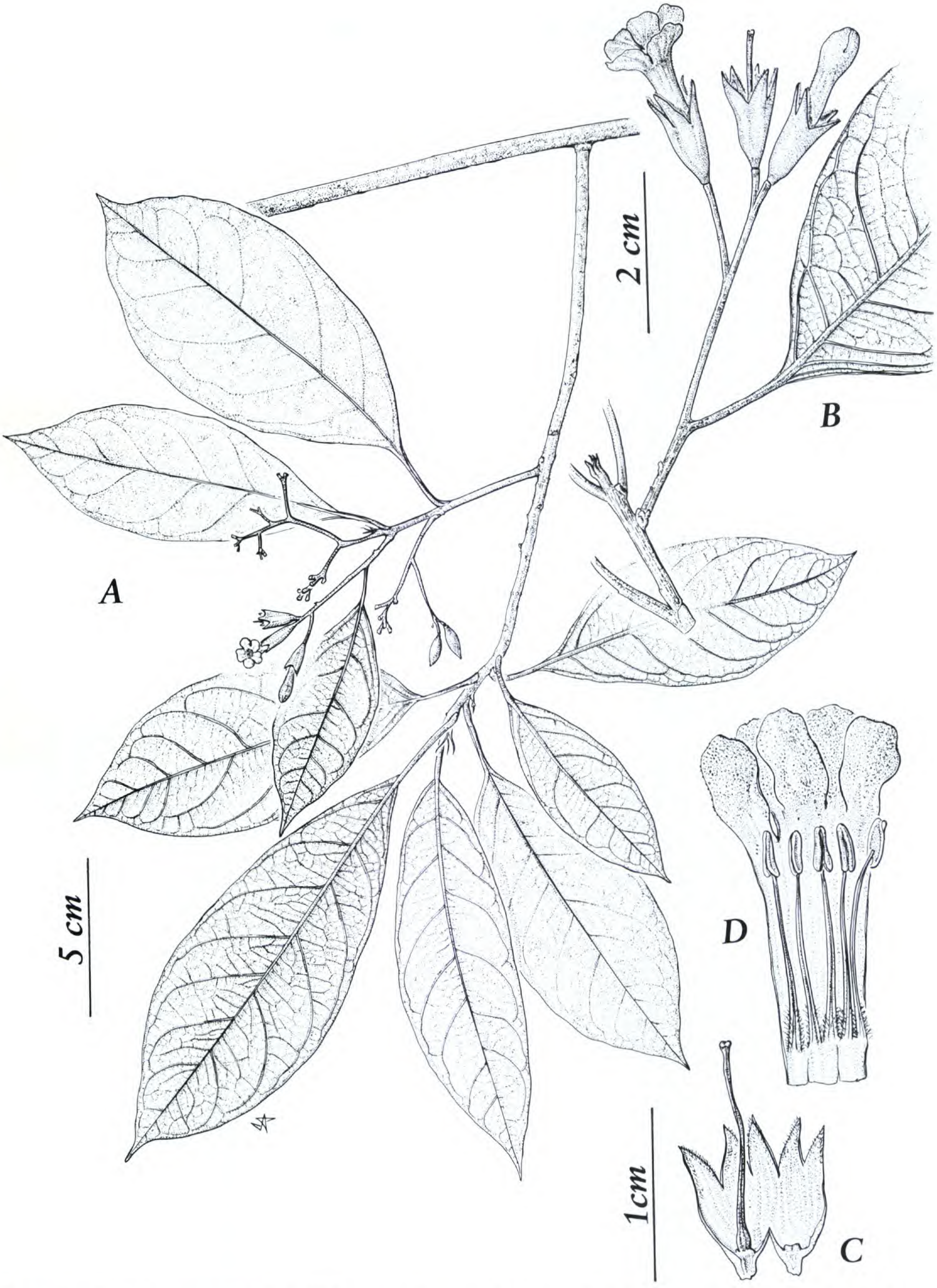

Figure 1. *Bourreria rinconensis* J. S. Miller. —A. Flowering branch. —B. Inflorescence with buds and open flower. —C. Open calyx showing the strigose interior margin of the lobes. —D. Open corolla showing staminal attachment. All from *Herrera 4350* (MO).

fers in having pubescent, shorter, broader leaves. *Bourreria cumanensis* and *B. quirosii* also are characterized by a fruit that breaks into 4 pyrenes, each attached to the gynobase with a slender fiber, a group that has been segregated as the genus *Crematomia* Miers (Miers, 1869). The fruit of *B. rinconensis* is unknown, but it would help indicate whether this new species is more closely allied to *B. cumanensis* and *B. quirosii*, species from dry forests with similar tubular corollas, or to *B. costaricensis* (Standley) A. Gentry and *B. grandicalyx* J. S. Miller & Sirot, which have large indehiscent fruits. The following key will help distinguish the species that are known from Costa Rica.

KEY TO THE COSTA RICAN SPECIES OF *BOURRERIA*

1a. Calyx rotate to campanulate, membranaceous.
  2a. Corolla less than 1.5 cm long; leaves scabrous above . . . . . *Bourreria litoralis* Standley
  2b. Corolla greater than 2 cm long; leaves glabrous above . . . . . *B. huanita* (Llave & Lexarza) Hemsley
1b. Calyx tubular, leathery.
  3a. Petioles greater than 10 mm long; leaf blade greater than 6 cm long, glabrous above; plants usually trees.
    4a. Corolla less than 2 cm long; calyx less than 8 mm long . . . . . *B. rinconensis* J. S. Miller
    4b. Corolla greater than 2 cm long; calyx greater than 13 mm long.
      5a. Flowering calyx greater than 2.5 cm long; edges of the lobes pubescent; fruits completely enclosed by the accrescent calyx . . . . . *B. grandicalyx* J. S. Miller & Sirot
      5b. Flowering calyx less than 1.8 cm long; edges of the lobes glabrous; fruits not enclosed by the calyx . . . . . *B. costaricensis* (Standley) A. Gentry
  3b. Petioles less than 10 mm long; leaf blade less than 7.5 cm long, scabrous above; plants shrubs . . . . . *B. quirosii* Standley

Tournefortia isabellina J. S. Miller, sp. nov. TYPE: Costa Rica. Puntarenas: Parque Internacional La Amistad San Vito coto Brus, Finca Cafrosa, 8°54′15″N, 82°46′50″W, elev. 500 m, 4 July 1990, *Roberto Delgado 47* (holotype, MO 05022359). Figure 2.

Liana, ramis velutinis isabellinis. Folia persistentia; lamina ovata, 8–12 cm longa, 4.9–7.2 cm lata, apice acuminata, basi rotundata, supra sparse sericea, infra velutina isabellina; petiolo 7–16 mm longo, supra canaliculato, velutino isabellino. Inflorescentia terminalis, cymosa, ca. 11 cm longa, 15 cm lata, ramulis velutinis isabellinis; pedicellis in fructu 1–3 mm longis. Flores non visi. Fructus 4-lobus, 2.5–3 mm longus, 3–4 mm latus, glaber.

Liana, the stems evenly dull golden brown velutinous, the hairs 1–1.5 mm long. Leaves alternate, persistent; leaf blade ovate, 8–12 cm long, 4.9–7.2 cm wide, the apex acuminate, the base rounded, the margin entire, the adaxial surface sparsely sericeous, more densely so along the midrib, the hairs appressed, dull golden brown, ca. 1 mm long, the abaxial surface evenly velutinous, more densely so on the midrib and secondary veins, the hairs erect, dull golden brown, 1–1.5 mm long, the venation brochidodromous, the midrib prominent, impressed above, rounded and raised below, the secondary veins arching, 6–8; petioles 7–16 mm long, dull golden brown velutinous. Flowers unknown. Infructescence terminal, a much-branched cyme, ca. 11 cm long, 15 cm broad, the branches dull golden brown velutinous. Fruits yellow with green markings, strongly 4-lobed, 2.5–3 mm tall, 3–4 mm broad, glabrous, borne 4–9 mm apart, on pedicels 1–3 mm long, the pedicels and persistent calyx with sparse, spreading, dull golden brown hairs, the 4 nutlets black, ovoid, ca. 1.5 mm long, colliculate.

Tournefortia isabellina is a distinctive species, and the epithet refers to the distinctive color of the hairs that cover the plant (Stearn, 1973). It is a member of section *Cyphocema* I. M. Johnston, an entirely Neotropical section that is characterized by a strictly vining habit and unusual fruits with four distinct nutlets that are surrounded and held together by a membranaceous epicarp (Johnston, 1930). The individual nutlets are angular on their ventral surface with the curved embryo bent around an intrusion of the ventral wall. The species of section *Cyphocema* typically have elongate corolla lobes and anthers that are connate apically (Miller, 1988). Johnston (1930) pointed out that while the section *Cyphocema* is well marked within *Tournefortia*, the species are notoriously difficult to separate. However, the majority of confusion lies with the South American species, and only two species have been recognized in Central America by recent authors (Nowicke, 1969; Gibson, 1970; Miller, 1988). Johnston's (1935) reference to *Tournefortia paniculata* Chamisso in Costa Rica probably refers to plants better placed in *T. maculata* Jacquin. The present species is quite distinctive in its terminal, dense, cymose inflorescence and distinctive indument. It differs from the other Central American species of the section in its much larger leaves and golden brown indument. The Central American

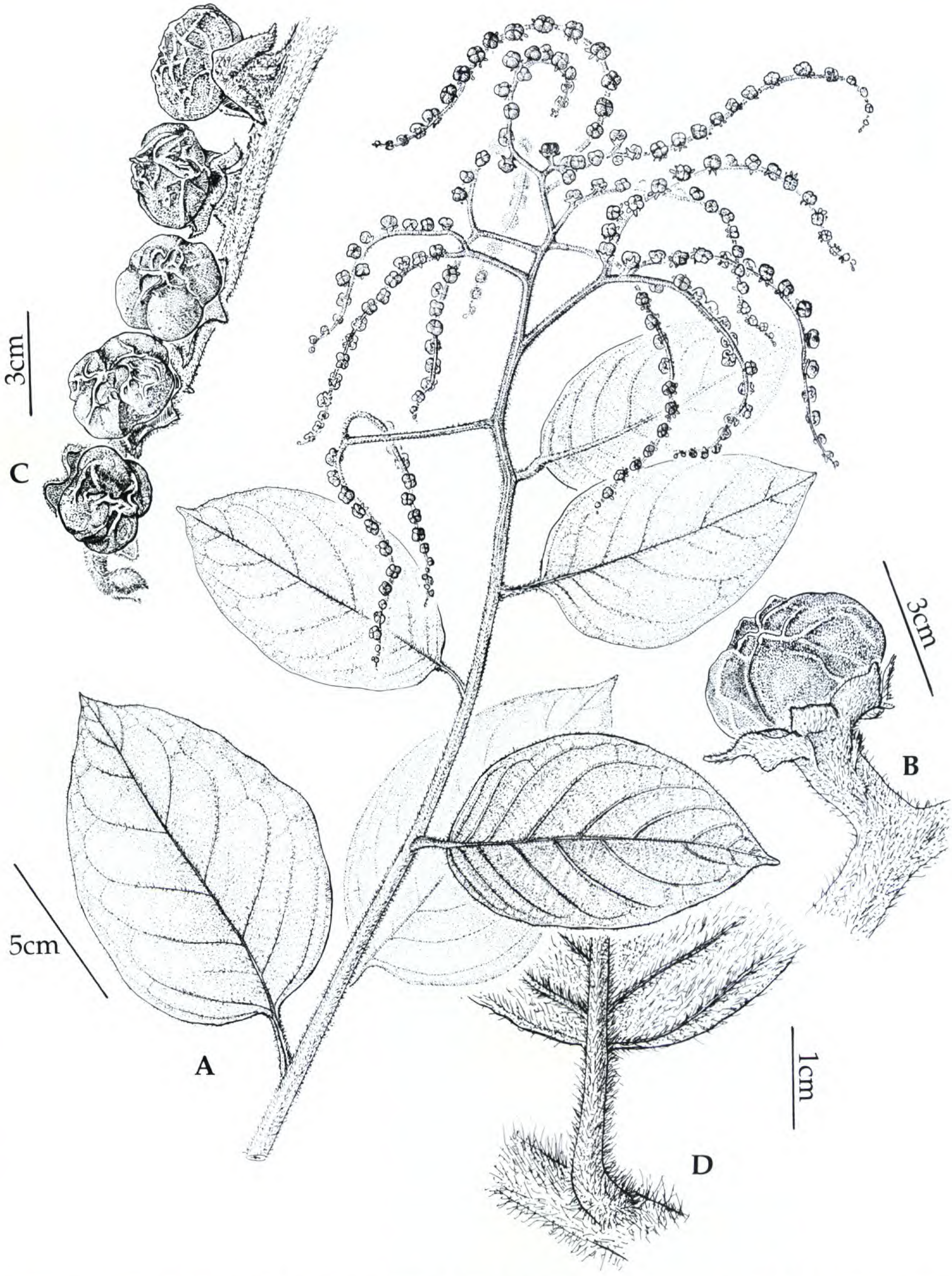

Figure 2. *Tournefortia isabellina* J. S. Miller. —A. Branch with cymose infructescence. —B. Mature fruit. —C. Infructescence branch. —D. Petiole and leaf insertion on branch. All from *Delgado 47* (MO).

species of *Tournefortia* sect. *Cyphocema* can be separated as follows.

KEY TO THE CENTRAL AMERICAN SPECIES OF *TOURNEFORTIA* SECT. *CYPHOCEMA*

1a. Plants evenly covered with a golden brown pubescence 1 mm or more long; leaves greater than 4.9 cm wide . . . . . *T. isabellina* J. S. Miller

1b. Plants glabrous to tomentose, the hairs white to yellowish, never golden brown; leaves less than 5 cm wide.

2a. Corolla tube 3.3–5 mm long; leaves glabrous to evenly short-strigillose below . . . . . *T. maculata* Jacquin

2b. Corolla tube 2–2.3 mm long; leaves densely white puberulent to tomentose below . . . . . *T. volubilis* L.

THE ORIGINAL PUBLICATION OF *CORDIA COLLOCOCCA* L.

Cordia collococca L. is widespread in tropical America, and the name has been considered to have been published in the second edition of *Species Plantarum* (Linnaeus, 1762) by most authors treating Central American species (e.g., Johnston, 1940; Gibson, 1970; Nash & Moreno, 1971; Miller, 1988). Johnston (1949) discovered that the name originated in a thesis of Carolus Gust. Sandmark, but attributed it to a later reprint (Linnaeus, 1760) rather than to its earliest publication. In 1759, Linnaeus published two treatments of Jamaican species based on specimens given to him by Patrick Browne and material collected by Hans Sloane currently deposited at BM. The first of these works, published 28 November 1759, *Plantarum Jamaicensis Pugillus* (Linnaeus, 1759a) mentioned only *Cordia bourreria* L. However, later in the same year, on 22 December, he published *Flora Jamaicensis* (Linnaeus, 1959b), the thesis of Carolus Gust. Sandmark, which was a list of binomial names for the plants collected by Browne and Sloane. Here Linnaeus published the name *Cordia callococca* by listing it with reference to page 166 of Browne's *Civil and Natural History of Jamaica* (Browne, 1756). The page reference provided by Linnaeus is incorrect, but on page 167, Browne did provide a description of *COLLOCOCCUS* I. *Folii rugosis venosis oblong-ovatis, floribus laxae racemosis,* the clammy cherry or turkey-berry tree. As Browne's *COLLOCOCCUS* 2. *Platyphyllus major, racemis umbellatis* on page 168 clearly seems to be the basis for *Cordia macrophylla* L., the species on page 167 is the only logical source of the name *Cordia callococca.* The name appears with the same orthography in a reprint of the *Flora Jamaicensis* article in volume 5 of *Amoenitates Academicae* (Linnaeus, 1760), a series of reprints of the Linnaean dissertations, but is finally corrected to the original spelling of Browne as *Cordia collococca* in edition 2 of *Species Plantarum* (Linnaeus, 1762).

While the publication of *Cordia collococca* is confusing, the 1759 *Flora Jamaicensis* does appear to be valid publication of the name conforming to relevant articles of the *International Code of Botanical Nomenclature* (Greuter et al., 1994). Although Linnaeus merely listed the name, he did provide a direct reference to a previously published description (article 32.4). Although the reference to Browne's earlier description is to an incorrect page number, article 33.3 states that "errors of bibliographic citation. . .do not invalidate publication of a new combination or avowed substitute." Also the change in orthography in the second edition of *Species Plantarum* in 1762 to conform with Brown's spelling of *Collococcus* seems to be an acceptable correction of an orthographic error as allowed by article 60.1. While some authors have questioned authorship of names in Linnaean theses, Rickett (1955) and Stearn (1957) have argued that names published in these works should be attributed to Linnaeus and not his students. Krok (1925) did not include *Flora Jamaicensis* in his list of Linnaean theses written by the students themselves, so it also seems that the name should be attributed to Linnaeus and not Sandmark. Thus the correct citation of original publication is:

Cordia collococca L., Fl. Jamaic. 14. [22 Dec.] 1757. TYPE: Jamaica. *P. Browne s.n.* (lectotype, designated by Miller (1988), LINN, Savage Catalog number 253.8).

Acknowledgments. I thank John Myers for the illustrations, Roy Gereau for help with the Latin descriptions, Amy Pool for drawing my attention to problems with the name *Cordia collococca,* Mary Stiffler for bibliographic assistance, and Lennart Andersson for helpful review comments.

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New Species of *Stemmadenia* and *Tabernaemontana* (Apocynaceae) from Costa Rica, Panama, and Colombia

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ABSTRACT. *Stemmadenia abbreviata* and *S. simulans* are described from Costa Rica and Panama, and *Tabernaemontana leeuwenbergiana* is described from Colombia.

Stemmadenia Bentham is a small genus of 10 species, confined primarily to Central America, although a few species occur in northern South America (Leeuwenberg, 1994). The genus is closely allied to *Tabernaemontana* L., but it is readily distinguished by its corolla tube with five staminal ridges below the anthers within. The presence of one corona, composed of five epistaminal ridges, within the corolla tube in some species of *Stemmadenia* and *Tabernaemontana* is an unusual character within the tribe Tabernaemontaneae. In *Stemmadenia* the corona is found in most species (e.g., *S. alfari* (Donnell Smith) Woodson, *S. donnell-smithii* (Rose) Woodson, *S. litoralis* (Kunth) L. Allorge), while in *Tabernaemontana* it is rarely present (e.g., *T. columbiensis* (L. Allorge) Leeuwenberg).

Study of material included among specimens received as gifts for identification revealed an undescribed species of *Tabernaemontana* from Colombia. In addition, while writing an account of the genus *Stemmadenia* for the *Manual to the Plants of Costa Rica*, two new species were discovered; they are described below.

Stemmadenia abbreviata J. F. Morales, sp. nov. TYPE: Costa Rica. Heredia: in forest along Río Peje, about 1 km S of La Selva (new property) S boundary, 13 Apr. 1982 (fl), *Hammel 11680* (holotype, INB; isotype, DUKE).

Arbuscula vel frutex 2 m alta, ramis furcatis, teretibus. Folia 5–14.5 × 1.5–6 cm, elliptica, glabra, membranacea, apice acuminata. Calycis segmenta 11–18 × 6–8 mm, tubo corollae 21–23 mm, salverformi, lobis 6–7 × 4 mm, antheris 3–4 mm. Fructus ignotus.

Shrub or small tree 2 m high; branchlets terete to subterete, forked, glabrous. Leaves petiolate; petiole glabrous, 3–9 mm long; blade 5–14.5 × 1.5–6 cm, membranaceous, elliptic, acuminate at the apex, cuneate at the base, entire, glabrous on both sides, with 8–10 pairs of upcurved secondary veins. Inflorescence pedunculate, 3–7-flowered, somewhat agglomerate, glabrous; peduncle 3–5 mm long, with several bracts; pedicels 5–9 mm; bracts scale-like, 2–3 mm; sepals white outside, green inside, foliaceous, erect, ovate to narrowly ovate, 11–18 × 6–8 mm, acute, subequal, glabrous, bearing 6–7 colleters inside, entire; corolla salverform, the tube white, lobes pale yellow, with 5 narrow staminal ridges 0.5 mm wide, corona composed of five epistaminal ridges ca. 0.5 mm wide above the insertion of the stamens; tube 21–23 mm long, almost cylindrical, ca. 3 mm wide above the base, twisted around the anthers; lobes obliquely obovate, 5–7 × 4 mm, obtuse, somewhat spreading to reflexed; stamens with apex 8–9 mm below mouth of corolla tube, inserted 7–8 mm from the base; anthers narrowly oblong, 3–4 × 1 mm, apex acuminate, sagittate at the base; ovary ovoid, 2–2.5 mm, glabrous, with a disk-like, ring-shaped thickening less than 1 mm high, adnate to base; style 5–6 mm; pistil head 1 mm. Fruits unknown.

Known only from the type collection, at 100–300 m. It flowers from March to May.

In Costa Rica, the type collection has been referred to *Stemmadenia robinsonii* Woodson, but *S. abbreviata* is easily recognized by its narrow salverform corolla, cylindrical and straight tube, with the lobes 5–7 mm long. The specific epithet refers to the short and inconspicuous corolla lobes.

Stemmadenia simulans J. F. Morales & Q. Jiménez, sp. nov. TYPE: Costa Rica. San José: Cantón de Puriscal, Zona Protectora La Cangreja, Faja Costeña del Valle de Parrita, Mastatal de Puriscal, Río Negro, 290–320 m, 3 Mar. 1994 (fl), *J. F. Morales, D. A. Smith & G. Smith 2414* (holotype, INB; isotypes, B, BR, C, CAS, CR, F, G, GH, INB, K, MEXU, MICH, MO, NY, P, UPS, US, USF, W, WAG, WIS, Z). Figure 1.

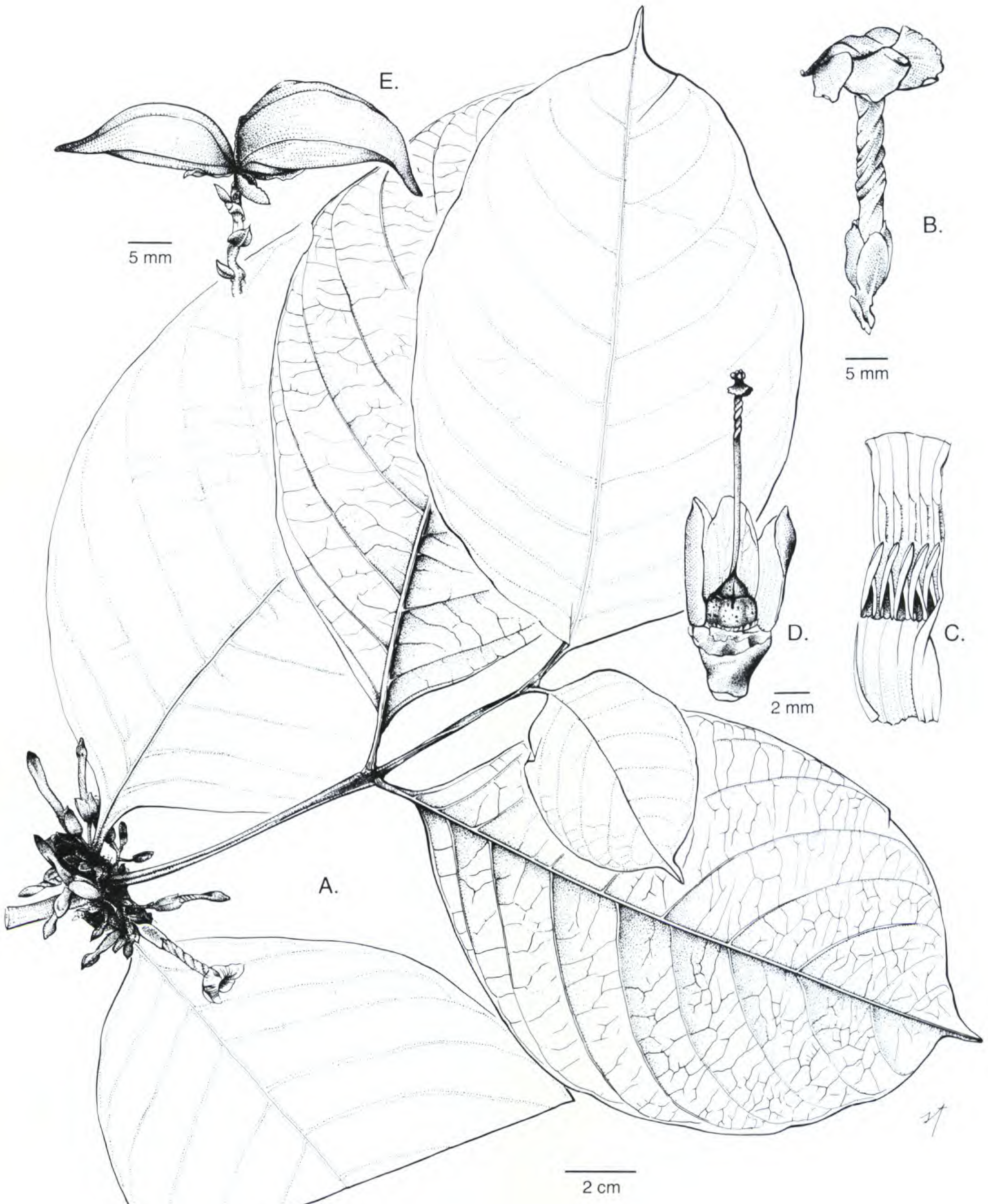

Figure 1. A–E. *Stemmadenia simulans* J. F. Morales & Q. Jiménez (*Morales et al. 2414*, INB). —A. Habit. —B. Calyx and corolla. —C. Opened corolla tube. —D. Pistil with sepals. —E. Fruit.

Arbuscula vel frutex 1–1.5 m alta, ramis furcatis, teretibus. Folia 8–37 × (3.2–)5–14 cm, elliptica vel obovata, glabra, membranacea, apice acuminata. Calycis segmenta 4–6 × 4–4.5 mm, tubo corollae 26–28 mm, salverformi vel anguste infundibuliformi, lobis 9–11 × 5–6 mm, antheris 5–6 mm. Fructus 22–32 × 9–12 mm.

Shrub or small tree 1–1.5 m high; branchlets terete to subterete, forked, glabrous. Leaves petiolate; petiole glabrous, 5–22 mm long; blade 8–37 × (3.2–)5–14 cm, membranaceous, elliptic to obovate; acuminate at the apex, cuneate at the base; entire, glabrous on both sides, with 11–12 pairs of upcurved secondary veins. Inflorescence inconspicuously pedunculate, 17–26-flowered, agglomerate; peduncle 1–2(–4) mm long, with several bracts; pedicels 4–10 mm; bracts scale-like, 1–2 mm, persistent; sepals green-yellowish, erect, unequal, ovate, 4–6 × 4–4.5 mm, obtuse, glabrous, bearing 5–7 colleters inside, entire; corolla yellow, salverform to very narrowly infundibuliform, with 5 narrow staminal ridges ca. 1 mm wide, corona composed of five epistaminal ridges above the insertion of the stamens; tube 26–28 mm long, almost cylindrical, ca. 3 mm wide above the base, twisted around the anthers; lobes obliquely obovate, 9–11 × 5–6 mm, obtuse, spreading to somewhat reflexed; stamens with apex 13–15 mm below mouth of corolla tube, inserted at 9–11 mm from the base; anthers narrowly oblong, 5–6 × 1 mm, apex acuminate, sagittate at the base; ovary ovoid, ca. 2 mm, glabrous, with a disk-like, ring-shaped thickening 1 mm high, adnate to the base; style 6–7.5 mm; pistil head 1 mm. Fruit of 2 separate mericarps; mericarps green-yellow, obliquely ellipsoid or pod-like, 22–32 × 9–12 mm, recurved, apiculate, sometimes caudate, with lateral ridges, smooth; aril orange. Seeds 7–8 × 3 mm, with longitudinal grooves.

This species is known from wet forests in Costa Rica and northwestern Panama, from 290 to 1000(–1400) m. It flowers from March to May, and fruits from July to September. Somewhat related to *Stemmadenia pauli* Leeuwenberg, it is easily recognized by its agglomerate 17–26-flowered inflorescences, conspicuous and persistent bracts, and persistent and shorter sepals.

The specific name recalls that *Stemmadenia simulans* looks like a species of *Tabernaemontana*. In fact, two collections of this species (*Busey 547* and *Gómez 19612*) with immature flowers were previously identified as *Tabernaemontana columbiensis*. However, the deep yellow corolla and the five narrow staminal ridges below the anthers within the corolla tube, confirm that this species should be included within *Stemmadenia*.

Stemmadenia simulans is morphologically very similar to *Tabernaemontana columbiensis*; the latter is easily separated, however, by its floral characters (larger sepals and inflorescences, persistent and conspicuous floral bracts), and smaller fruits (22–32 mm vs. 35–55 mm in *T. columbiensis*) and seeds (7–8 mm vs. 9–12 mm).

Paratypes. COSTA RICA. **Puntarenas:** Fila de Cal, between Las Cruces and Nelly, *Gómez 19612* (MO). **San José:** Zona Protectora La Cangreja, Santa Rosa de Puriscal, *Morales 278* (INB); Mastatal de Puriscal, Río Negro, *Morales 3128* (INB, MO); Zona Protectora La Cangreja, Mastatal de Puriscal, *Ramírez et al. 44* (CR, INB, MO); Mastatal de Puriscal, *Zamora et al. 1271* (INB, MO). PANAMA. **Chiriquí:** Burica Península, San Bartolo Límite, 20 km W of Puerto Armuelles, *Busey 547* (MO).

Tabernaemontana leeuwenbergiana J. F. Morales, sp. nov. TYPE: Colombia. Nariño: trail from La Planada to Pielapi, wet lower montane cloud forest, 1600–1800 m, 22 July 1988 (fl), *Gentry et al. 63607* (holotype, INB; isotype, MO).

Arbuscula vel frutex, 3–4 m alta, ramis furcatis, teretibus. Folia 41–45 × 26–29 cm, elliptica, glabra, membranacea, apice acuminata. Calycis segmenta 3–4 × 2–3.5 mm, tubo corollae 21–24 mm, salverformi, lobis 8–12 × 5–6 mm, antheris 5–6 mm. Fructus ignotus.

Shrub or small tree, 3–4 m high; branchlets terete to subterete, glabrous, forked. Leaves petiolate; petiole glabrous, 26–30 mm long; blade membranaceous, 41–45 × 26–29 cm, broadly elliptic; acuminate at the apex, cuneate at the base; entire, glabrous on both sides, with 19–21 pairs of upcurved secondary veins; tertiary venation reticulate. Inflorescence pedunculate, 18–23-flowered, corymbose, lax; peduncle 24–26 mm long, with several bracts; pedicels (10–)15–20 mm; bracts few, scale-like, 2–3 mm; sepals erect, ovate, 3–4 × 2–3.5 mm, obtuse to rounded, glabrous, bearing many colleters inside, entire; corolla salverform, white, glabrous; tube 21–24 mm long, almost cylindrical, ca. 3 mm wide above the base, somewhat twisted around the anthers; lobes obliquely obovate, 8–12 × 5–6 mm, obtuse, somewhat spreading; stamens with apex 5–6 mm below mouth of corolla tube, inserted at 12–13 mm from the base; anthers narrowly triangular, 5–6 × 1 mm, apex acuminate, sagittate at the base; ovary ovoid, 2–2.5 mm, glabrous, with a disk-like, ring-shaped thickening 1 mm high, adnate to base; style 5–6 mm; pistil head 1 mm. Fruits unknown.

This species is known only from the type locality, at elevations of 1600–1800 m. It resembles *Tabernaemontana maxima* Markgraf, but differs by its conspicuously petiolate leaves (26–30 mm vs. 1–4

mm), shorter sepals (3–4 mm vs. 6–12 mm), and corolla lobes (8–12 mm vs. 4–5 mm). From *T. markgrafiana* J. F. Macbride it differs by its broadly elliptic leaves (vs. elliptic to narrowly elliptic in *T. markgrafiana*), lax inflorescence (vs. dense and aglomerate), and longer sepals (3–4 mm vs. 2–3 mm).

Tabernaemontana leeuwenbergii is named after Anthony (Toon) Leeuwenberg (WAG), in recognition of his extensive taxonomic work in the tribe Tabernaemontaneae, especially in the genus *Tabernaemontana*, and for his encouragement of my studies on Apocynaceae.

Acknowledgments. I thank the directors and curators of COAH, COL, CR, DUKE, F, HB, HUA, INPA, K, MO, NY, RB, UB, UPS, and WAG for the loan of material. The line drawings of *Stemmadenia simulans* were prepared by Silvia Troyo.

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Miscellaneous Notes in *Temnadenia* and *Laubertia* (Apocynaceae)

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ABSTRACT. The new combination *Temnadenia odorifera* (Vellozo) J. F. Morales is proposed here. *Laubertia gentlei* Lundell is reduced to synonymy of *L. peninsularis* Woodson.

While preparing the treatment of Apocynaceae for *Flora Mesoamericana* and other projects from South America, I determined the need for the following nomenclatural changes.

NOTES IN *TEMNADENIA*

The name *Temnadenia stellaris* (Lindley) Miers has been widely used in publications and identifications since Woodson's (1935a) monograph. However, while preparing the reevaluation of the genus *Echites* and *Prestonia*, I concluded that the original illustration of *Echites odorifera* Vellozo included in *Florae Fluminensis* (Vellozo, 1829), "referable to some species of *Temnadenia*" fide Woodson (1935a), clearly represents a typical specimen of *T. stellaris*. Therefore, a new combination is necessary and is here proposed.

Temnadenia odorifera (Vellozo) J. F. Morales, comb. nov. Basionym: *Echites odorifera* Vellozo, Fl. Flumin. 104. 1829 ["1825"]. TYPE: t. 28 in Vellozo, Fl. Flumin. Icones 3, 1831 ["1827"].

Echites stellaris Lindley, Edwards's Bot. Reg. 20: pl. 1664. 1835. Syn. nov. *Temnadenia stellaris* (Lindley) Miers, Apocyn. S. Amer. 210. 1878. TYPE: "introduced from Rio Janeiro to the Horticultural Society by the Hon. Robert Gordon."

For the complete synonymy see Woodson (1935a).

NOTES IN *LAUBERTIA*

Laubertia gentlei Lundell was distinguished from *L. peninsularis* Woodson based on flower size and leaf indument (Lundell, 1976). However, careful examination of the holotypes has shown that *L. gentlei* is the same species as *L. peninsularis* and is therefore reduced to synonymy.

For the complete synonymy and a key to the currently accepted species of *Laubertia*, see Woodson (1935b, 1938).

Laubertia peninsularis Woodson, Ann. Missouri Bot. Gard. 23: 374. 1936. TYPE: British Honduras [Belize]: Undesignated locality near Belize-Guatemala boundary, *Schipp s.n.* (holotype, MO).

Laubertia gentlei Lundell, Wrightia 5: 256. 1976. Syn. nov. TYPE: British Honduras [Belize]: Toledo District: Manga Camp, Edwards Road beyond Columbia, 12 Apr. 1948, *Gentle 6505* (holotype, TEX; isotypes, F, MO; photograph, INB ex F).

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A New Species of *Votomita* (Melastomataceae) from Venezuela, with Thoughts on Ovule and Seed Number and Seed Size

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ABSTRACT. A new species of *Votomita* from southern Venezuela is described, illustrated, and distinguished from its relatives on the basis of fruiting material; certain useful floral characters can also be determined from the specimen. The new species illustrates a general condition in subfamily Memecyleae, i.e., a relatively large number of ovules is produced yet only one or a few large seeds are formed. Ovule and seed numbers are discussed, seed volumes are calculated for *Mouriri* and *Votomita*, and possible explanations for the differences are explored.

Votomita ventuarensis Morley, sp. nov. TYPE: Venezuela. Terr. Fed. Amazonas: Dept. Atabapo, bosques medios y bajos inundables en el rio Ventuari-Macabana, 4°15′N, 66°20′W, 140 msnm, Sep. 1989, *Luz Delgado 594* (holotype, MO; isotype, PORT). Figure 1.

Arbor usque 15 m alta; pagina inferior costae mediae anguste 2-alata ad angulos, minute puberula; cryptae stomatatae unaquaeque cavitatibus 1–5; epidermes folii sine pigmento; hypodermis absens; stamina monadelpha; ovarium 4-loculare ovulis 22–25 axillaribus; semen unicum, globosum.

Tree to 15 m high, glabrous except for the leaf midrib; young twigs rounded. Petioles 4.5–6 mm long; blades 7.9–12.4 cm long, 4.1–6 cm wide, ovate-elliptic to elliptic, acute at base, abruptly acuminate at the apex with an acuminum 0.7–1 cm long; midrib low-rounded to plane or slightly grooved adaxially when dry, prominent abaxially, flat and winged on the edges, the undermidrib minutely puberulent with hairs 20–40 μm long; lateral nerves when dry faintly visible or invisible adaxially, faintly visible abaxially. Midrib xylem tubular; stomatal crypts 30–36 per mm² near the margin to 54 near the midrib, with (1–)2–5 cavities each, 50–60 μm high; adaxial epidermis of uniform thickness, 29–31 μm thick including the cuticle, mostly one cell thick, occasionally two, mucilage walls none, the cytoplasm unpigmented and clear till stained, the inner walls straight and parallel with the outer ones; cuticle thin; abaxial epidermis also unpigmented; hypodermis none; foliar sclereids all terminal on the veinlets, irregularly stellate, often with an irregular horizontal central body 1–4 times as long as wide. Peduncles 1 per side at leafless nodes of twigs 3–4 mm thick below the leaf zone, 10.5–14 mm long with 2 internodes, the lower 0.5–1 mm long, the upper 10–13 mm, 1-flowered; bracts deciduous before fruit formation; pedicels 12–13 mm long in fruit; ovary locules 4, placentation axile, ovules 4–11 per placenta, 22–25 in all; fruits yellow to orange, ellipsoid, crowned with the calyx, 17–18 mm long including calyx by 12–14 mm diam. when dry, 20–21 mm long by 13–16 mm when boiled, the fruiting calyx 6.4–6.7 mm diam., 3–3.3 mm deep, the lobes low-triangular, 0.8–1.2 mm high, 4–5.2 mm wide; seed 1, spheroid, 9.7–9.9 mm high, 8.8–9.6 mm thick, with an irregularly elliptic raised area (function unknown) ca. 4 mm from the broken chalazal strand, the raised area 6 mm long, 4 mm wide, 0.5–1 mm high, with edges that overhang 0–0.5 mm; the raised area presumably includes the micropyle. Petal scars on the fruit rounded-triangular, 2.3–2.7 mm wide, 0.9–1.2 mm long; stamen scars 8, the filament scars broad, thin, and united, forming a continuous ring 3.2–3.7 mm in outside diam., 0.2–0.5 mm thick, the stamens thus monadelphous; thecae adaxial on the filaments and placed low so that their bases leave imprints 0.9–1.2 mm wide, 0.8–1.0 mm thick radially around the style base, the total stamen thickness at base 1.0–1.3 mm.

Distribution. Known only from the type locality east of San Fernando de Atabapo, northwest of central Amazonas, Venezuela.

Local name. Cometure tierra firmero.

Although the type specimen bears only ripe fruits, the filament scars and anther imprints on the fruits yield useful floral information, and with careful dissection of the 1-seeded fruit (when boiled) all or most of the undeveloped ovules can be found and the nature of the placentation determined, in spite of the compaction and distortion that have taken place.

The new species is unique in the genus in its unpigmented epidermises. Further distinctions of this plant from the other species follow, starting

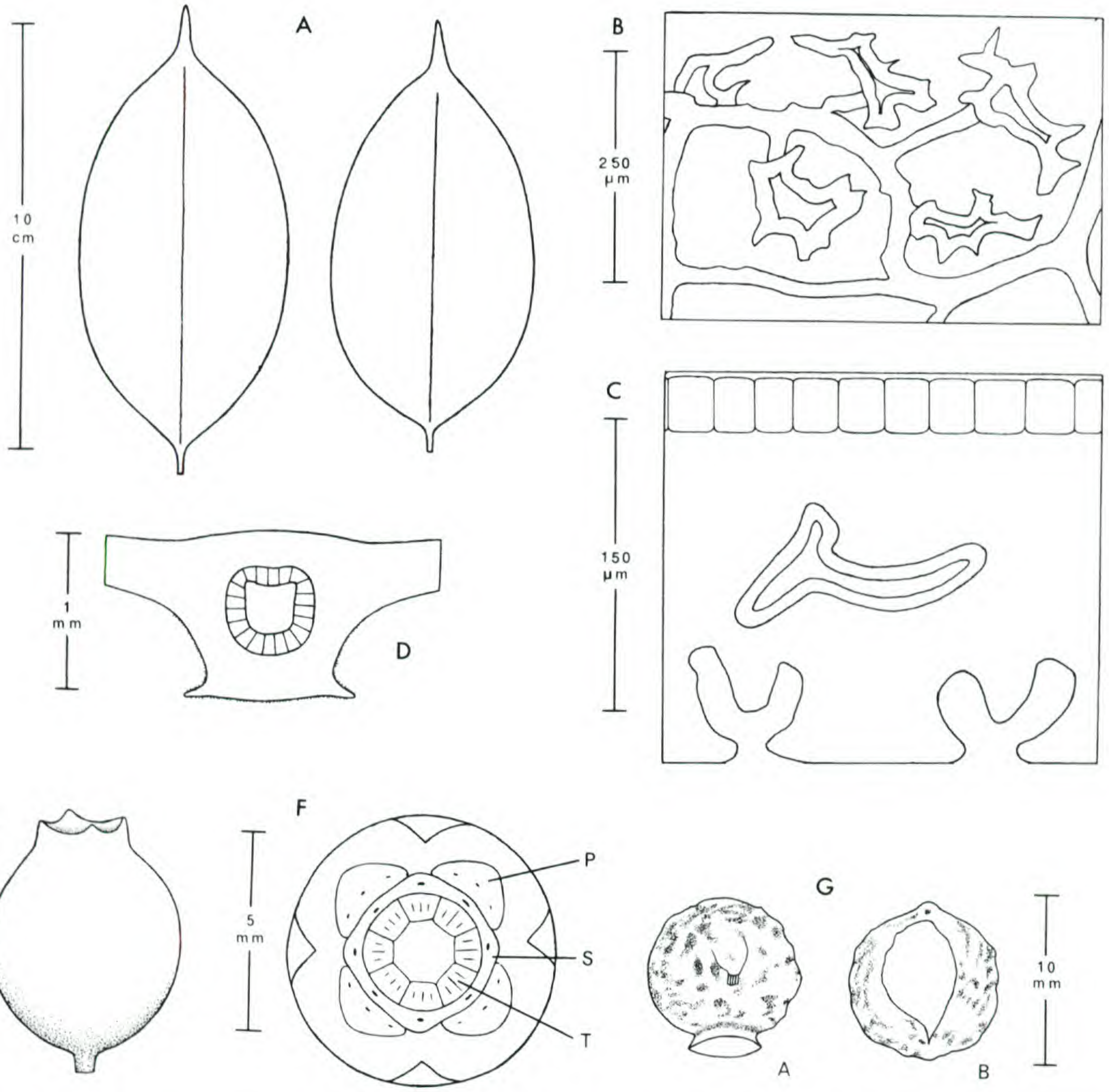

Figure 1. *Mouriri ventuarensis* Morley. —A. Leaves. —B. Cleared portion of leaf blade showing veins and terminal sclereids. —C. Cross section of leaf blade showing upper epidermis, a sclereid, and stomatal crypts. —D. Cross section of leaf midrib. —E. Fruit. —F. Apex of fruit showing the calyx lobes and the scars and imprints of the other floral appendages: P, petal scar; S, scar of monadelphous stamens; T, imprints of anther thecae. —G. Seed: A, broken chalazal strand shows halfway up; B, shape of elevated outgrowth is shown; the chalazal strand is at the top.

with those most easily and clearly distinguished: *V. pubescens* Morley differs in the pubescent underside of its lamina; *V. guianensis* Aublet, *V. monantha* (Urban) Morley, and *V. orinocensis Morley* have separate filaments and only 10 or fewer ovules per ovary; *V. monadelpha* (Ducke) Morley has 48 ovules per ovary and two very different forms of foliar sclereid; *V. plerocarpa* (Morley) Morley has 45 ovules per ovary, lateral nerves of the leaf moderately prominent, stomatal crypts 32–38 μm high, an irregular upper epidermis in which the lower walls of the cells are mostly strongly rounded and variable in depth, and mucilage walls occasional in the epidermis; *V. orbinaxia* Morley has a glabrous unwinged midrib when viewed abaxially, separate stamens, 36 ovules, and columnar sclereids. *Votomita cupuliformis* Morley & Almeda differs in its abaxially glabrous midrib, 16 ovules, simple stomatal crypts, columnar foliar sclereids, and epidermal cells with numerous mucilage walls. *Votomita roraimensis* Morley departs in having petioles 1.5–2.5 mm long, a seed lacking an elevated elliptic disc, 15–16 ovules, and a double epidermis with a deep inner layer and occasional mucilage walls.

Of the other species, the one most similar to *Votomita ventuarensis* is *V. plerocarpa*, which agrees in its abaxially puberulent midrib, the form of its foliar sclereids and stomatal crypts, its monadelphous stamens with low-placed thecae, and its axile placentation. The features differentiating *V. plero-*

carpa from *V. ventuarensis* are stated above. When flowering plants of the new species are found, and fruiting material of *V. plerocarpa* is collected, the differences between the two doubtless will become more apparent. As it is, the numerous anatomical features that occur in the genus greatly facilitate the distinctions between these two species as well as between all the species of the genus. Long experience has shown these features to be as reliable as morphological ones.

Although only two fruits of the new species could be dissected owing to scarcity of material, both were one-seeded even though there were 20–25 ovules present; one-seeded fruits are also found in the other species of the genus for which fruits are available: *V. guianensis* (9–10 ovules), *V. monantha* (5–8 ovules), *V. pubescens* (20–26 ovules), and *V. roraimensis* (15–16 ovules). All seeds are relatively large.

A similar pattern of ovule to seed number and large seed size occurs in the closely related genus *Mouriri* and in its Old World relatives. However, in *Mouriri* many species have more than one seed. *Mouriri trunciflora* Ducke has 40–80 ovules but only 2–12 seeds; *M. dimorphandra* Morley, 42–71 ovules and 2–5 seeds; *M. brachyanthera* Ducke, 54–57 and 2–4; *M. ficoides* Morley, 50–60 and 2–5; *M. subumbellata* Triana, 15–42 and 1–8; *M. crassifolia* Sagot, 30–38 and 1–6; *M. lunatanthera* Morley, 28–43 and 6; *M. cauliflora* Martius ex DC., 23–40 and 5 (Morley, 1976). All the rest with known flowers have 4–30 ovules and those with known fruits have 1–5 seeds except for *M. oligantha* Pilger, which has 9–12 ovules and 1–6 seeds; the ovules are always 3–20 times as many as the seeds, with the possible exception of *M. oligantha* (Morley, 1976). It is believed that the wide range in ovule numbers can be read as a form-series from many to few.

The Old World genera *Lijndenia*, *Memecylon*, *Spathandra*, and *Warneckea* are similar to *Votomita* in ovule and seed numbers. The flowers produce 2–19 ovules (Bremer, 1981, 1982, 1983; Jacques-Félix, 1978, 1984, 1985) but only 1(–2) seed(s). The consistently single seed of *Votomita* and the one or occasionally two seeds of the Old World genera agree with the interpretation of these on other grounds as generally more specialized than *Mouriri*.

It would appear that the consistent and apparently inefficient pattern in the Memecyleae in which one to many ovules do not function must result from a hormonal cut-off from the undeveloped ovules. The small number of ripened seeds, which are relatively large, must be somehow advantageous in relation to the final fruit size, the nature of the fruit-eaters, and/or the conditions encountered by the dormant or germinating seed. The reduction in number of seeds per fruit must reflect some major shift in the ecology of the group.

In all probability the Memecyleae (see Renner, 1993) are evolving from a group in which the fruits have or had many small seeds with a matching ecology, with conditions apparently wasteful of ovules initially being produced as the ecological adaptation changed and evolution proceeded in the direction of few large seeds. Progressively fewer ovules are produced in the more advanced members: as few as five in one species of *Votomita*, four in a *Mouriri*, and two in some *Lijndenias*.

It was thought desirable to find a practical way to describe seed size since sizes vary greatly in the subfamily, particularly in *Mouriri*. Volume was judged to be the critical parameter. To determine the approximate volume the formula for the volume of an ellipsoid was used: $\frac{1}{3}\pi \times$ (½ length × ½ width × ½ thickness of the seed). Even with some divergence from a true ellipsoid this formula should give a useful approximation of size.

In order to make a limited check on the accuracy of the above method, displacement tests were made with the relatively few seeds of *Mouriri* and *Votomita* available at the MIN herbarium. Seeds of 15 species were measured by placing them in 95% EtOH in standard graduated cylinders of three sizes and measuring the fluid rise. The accuracy of this method is limited by the difficulty of getting an exact reading of fluid level, especially when the seed is a poor fit in the tube. In 11 of the 15 seeds the figure calculated from measurements was between 1 and 10% of the displacement figure, from low to high. The exceptions were 11%, 14%, and 21% high, the 21% being a seed covered with irregular tubercules (the seeds were calipered). I conclude that at least in the Memecyleae the measurements calculated by formula are accurate within 10% of the true volume in most cases and rarely exceed a differential of 20%.

With one exception the largest seeds in *Mouriri* occur in the two most primitive sections, *Taphroxylon* and *Abundiflos*, where approximate seed volumes range from (34–)777 to 3041 mm^3. The exception is *M. megasperma* Morley, which has a volume of 3806 mm^3, the largest known seed in the genus; known only in fruit, the relations of this species are uncertain except that it is a specialized plant and is not in either of the aforementioned sections. Seed volumes in *Mouriri* other than in the two most primitive sections or *M. megasperma* vary from 39 to 1341 mm^3. Only two species, *M. arborea* Gardner and *M. crassisepala* Morley, have seeds ex-

ceeding 780 mm³. The smallest seeds are those of *M. viridicosta* Morley, 34 mm³, an anomalous member of the section *Taphroxylon*; next smallest are seeds of *M. helleri* Britton, 39 mm³. Seed volumes in the five species of *Votomita* known in fruit range from 56 to 493 mm³. The four Old World genera are estimated from illustrations or published dimensions to have seed volumes of about 20–680 mm³.

Since the largest seeds of *Mouriri* occur mostly in the most primitive sections it is possible that large seed size played a part in the origin of the subfamily. It has been suggested that larger seeds favor survivability of the seeds or seedlings (Richards, 1996; Howe, 1986), and it is stated that the large-seeded local species in a study area at Los Tuxtlas, Mexico, have higher establishment rates in the closed canopy forests there than smaller-seeded plants (Martinez-Ramos & Soto-Castro, 1993). Howe (1993) made the general observation that trees with specialized dispersal systems often have large seeds. However, as van der Pijl pointed out (1969), ". . .small and large seeds have many backgrounds!" This last point is illustrated in *Mouriri*, where most of the species with large seeds occur in the two most primitive groups, but one species, *M. megasperma*, appears to have evolved large seeds secondarily in an advanced group.

The general trend in the Memecyleae toward reduction in number of seeds suggests either that a one-seeded fruit makes the most desirable package for convenient frugivor dispersal, or that the plant resources would not permit ripening many large seeds in the same fruit, or perhaps a combination of the two. Unknown factors are probably involved.

The existence in the Memecyleae of plants with many ovules, presumably a primitive condition, suggests that any search for its ancestral connections should be among groups that also have numerous ovules.

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Senecio aetfatensis (Asteraceae: Senecioneae), a New Species from Zimbabwe

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ABSTRACT. A new species, *Senecio aetfatensis*, is described from the Chimanimani Mountains of eastern Zimbabwe.

During the AETFAT post-congress excursion in the mountains of eastern Zimbabwe in February 1997, I was fortunate to find and collect an undescribed species of *Senecio*. It is a pleasure to name the new species for the Association pour l'Étude Taxonomique de la Flore d'Afrique Tropicale (AETFAT), which held its XVth Congress in Harare on 3–7 February 1997.

Senecio aetfatensis B. Nordenstam, sp. nov. TYPE: Zimbabwe. Chimanimani National Park, along footpath from entrance office to Mountain Hut, ca. 1600 m, 11 Feb. 1997, *Nordenstam 9292* (holotype, S; isotypes, K, MO, SRGH). Figure 1.

Herba perennis ramosissima 0.6–1.5 m alta et lata. Caules et rami brevi-villosi. Folia alterna sessilia herbacea 3–6(–8) cm longa 1.5–3.5 cm lata plana pinnatisecta sparse hirsutula, basin versus angustata, basi semiamplexicaulia auriculata; lobis utrinque 3–5 oblongis pinnatilobatis vel dentatis acutis. Capitula 3–10 corymbosa radiata pedunculis gracilibus 1–5 cm longis. Involucrum campanulatum; involucri bracteae 13–21 subuniseriatae lineari-lanceolatae 4–5.5 mm longae 0.5–1.5 mm latae virides glabrae nervis 1–2 resiniferis marginibus anguste membranaceis apicibus acutis–acuminatis puberulis. Calyculi bracteae 5–8 anguste triangulares acutae. Receptaculum planum nudum alveolatum. Flosculi radii plerumque 8 flavi. Flosculi disci numerosi, corolla flava tubulosa superne dilatata quinquelobata. Antherae basi breviter sagittatae, collum filamenti basi dilatatum. Styli rami lineares, areis stigmaticibus separatis, apicibus truncatis pilis eferrentibus brevibus. Cypsela anguste elliptico-oblonga costata breviter villosa. Pappi setae numerosae graciles minute barbellatae caducae.

Much-branched herb forming a bushy rounded clump 0.6–1.5 m high and wide. Stems and branches somewhat brittle, shortly villous. Leaves alternate, sessile, herbaceous, soft, doubly pinnatisect, 3–6(–8) cm long, 1.5–3.5 cm wide, flat, shortly hirsute, green above, paler below, with 4–5 lobes on each side, narrowed toward the base and petiolariform; leaf lobes 3–5 on each side, oblong, pinnately lobed or dentate, acute; leaf base half-clasping and auriculate with dissected or dentate small ears. Capitula 3–10 in a terminal, laxly branched corymbiform synflorescence; peduncles 1–5 cm long, slender. Involucre campanulate; involucral bracts 13–21, subuniseriate, linear-lanceolate, 4–5.5 mm long, 0.5–1.5 mm wide, green with narrow membranous margins, 1–2-veined with resiniferous veins, acute to acuminate, tips puberulous, otherwise glabrous. Calycular bracts 5–8, 1–2 mm long, narrowly triangular, flat, acute. Receptacle flat, naked, alveolate. Ray florets (5–)8; corolla yellow; tube 2–3 mm long, somewhat glandular-puberulous; lamina elliptic-oblong, 4.5–8 mm long, 2.5–3.5 mm wide, 4-veined, patent or rolled back. Disc florets ca. 40–60; corolla yellow, tubular, widening above to a narrowly campanulate limb 2–3 mm long, 5-lobed, 3.5–4.5 mm long; lobes deltoid or triangular-ovate, 0.5–0.7 mm long, minutely papillate outside toward the apex, with a central resiniferous vein. Anthers 1.3–1.7 mm long including appendage; apical appendage oblong-ovate, obtuse; anther base shortly sagittate; filament collar basally swollen ("balusterform"). Style branches linear, 0.7–1 mm long with stigmatic areas separated, apex truncate with short sweeping-hairs. Cypsela narrowly elliptic-oblong, terete, 2–2.5 mm long, ca. 0.6 mm wide, with ca. 8 light brown ribs, white-villous on and between ribs, hairs mucilaginous when soaked. Pappus bristles numerous, erect, 3–4 mm long, slender, minutely barbellate, white, caducous.

The single individual seen by me was growing from a crevice on a vertical rock face with a western aspect, and the specimens collected by Wild were stated to grow among crags. The new species belongs to *Senecio* sect. *Senecio*, but it is difficult to point out any very close relatives. There are a number of *Senecio* species with pinnatisect leaves in southern Africa, but they are all clearly distinct. Some are annuals with either purple florets (e.g., *S. cakilefolius* DC., *S. eenii* (S. Moore) Merxmüller) or yellow florets, but then with smaller capitula (e.g., *S. cryphiactis* O. Hoffmann, *S. piptocoma* O. Hoffmann). Some forms of *S. consanguineus* DC. are

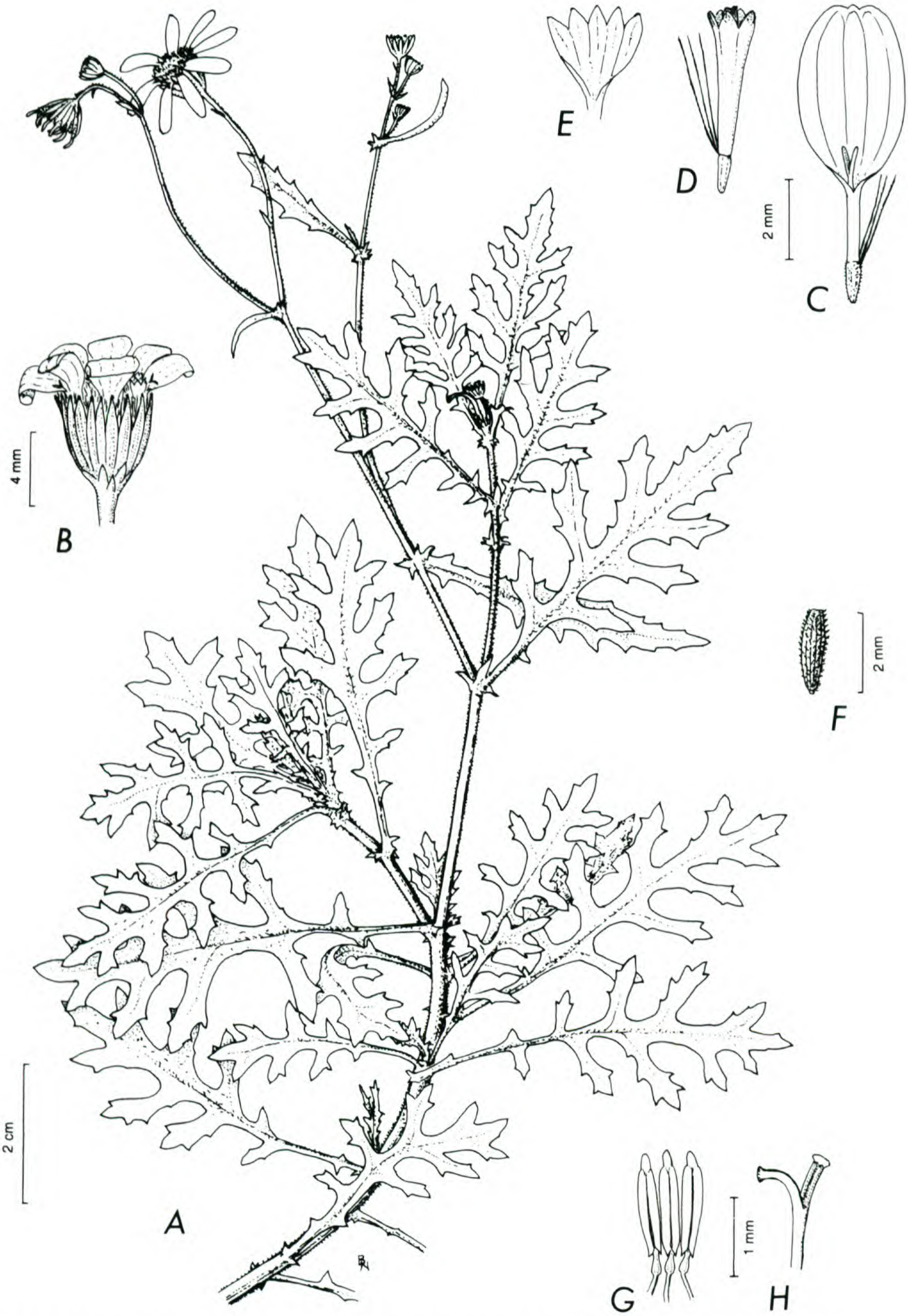

Figure 1. *Senecio aetfatensis* B. Nordenstam. —A. Flowering branch. —B. Capitulum. —C. Ray floret (most pappus bristles removed). —D. Disc floret (most pappus bristles removed). —E. Corolla of disc floret, opened longitudinally. —F. Cypsela, pappus removed. —G. Stamens. —H. Style branches from disc floret. Drawn by the author (based on *Nordenstam 9292*, S).

also superficially similar to the new species, but clearly distinct by the erect annual habit, longer involucral bracts, and short rays. Among perennial species with some resemblance, *S. cinerascens* Aiton has leaves white-woolly below and larger flower heads, *S. poseidonis* Hilliard & Burtt has purple or white florets, and *S. rhyncholaenus* DC. has viscid stems and leaves and discoid, white-flowered, narrow capitula. The closest relative may be *S. subrubrifolius* O. Hoffmann, a species known from the Orange Free State, Transvaal, Natal, and Lesotho, similar in habit and leaf shape, but different by the turbinate, discoid flower heads, and the glandular pubescence making the plant viscid.

The bushy habit, the pinnatisect flat leaves, and the yellow, distinctly radiate capitula of *S. aetfatensis* are reminiscent of the genus *Cineraria,* which explains the labeling of the paratype as "*Cineraria* sp." However, this is a superficial resemblance, the new species lacking the generic characters of *Cineraria* such as the flattened cypsela.

Paratypes. ZIMBABWE. Chimanimani Mts., Mt. Peza, 6500 ft., 15 Oct. 1950, *H. Wild 3621* (BR, S, SRGH). [A pencilled note on the SRGH sheet suggests that *Gilliland 1890* may be the same species. The latter collection was searched for but not found in several possible herbaria (e.g., J, K, LD, PRE, SRGH).]

New Taxa of *Sarcopera* and *Marcgraviastrum* (Marcgraviaceae) from the Guayana Shield

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ABSTRACT. A new species, *Sarcopera flammifera*, and a new subspecies, *Sarcopera tepuiensis* subsp. *coccinea*, are described. Three new combinations, *Sarcopera aurantiaca*, *Sarcopera tepuiensis*, and *Marcgraviastrum pendulum*, are validated.

The planned treatments of Marcgraviaceae in the *Flora of the Venezuelan Guayana* and *Flora of the Guianas* series necessitate publication in advance of some new taxa in the genera *Marcgraviastrum* and *Sarcopera*, two genera recently validated by de Roon and S. Dressler (1997). A number of new combinations and new taxa were proposed by Bedell (1985) in her doctoral thesis, but subsequently only some of them were validly published (Bedell, 1988, 1993; de Roon & Dressler, 1997).

Sarcopera Bedell is based on *Norantea* subg. *Pseudostachyum* Delpino (Delpino, 1869). The genus is characterized by a spicate inflorescence with the nectariferous bracts inserted at the base of the small flowers. In her thesis Bedell proposed three new species of *Sarcopera* from the region, "*S. atrovinosa*, *S. coccinea* and *S. flammifera*." A new study of the available collections led us to the conclusion that only *S. flammifera* should be recognized as a new species. The proposed "*S. coccinea*" is here treated as a subspecies of *S. tepuiensis*.

Marcgraviastrum (Wittmack ex Szyszylowicz) de Roon & S. Dressler is based on *Norantea* subsect. *Marcgraviastrum* Wittmack ex Szyszylowicz (Szyszylowicz, 1893). The genus is characterized by an umbelliform inflorescence.

Two generic transfers proposed by Bedell are herein validated and attributed to her, following an agreement between her and the senior author.

Sarcopera aurantiaca (Spruce ex Gilg) de Roon & S. Dressler, comb. nov. Basionym: *Norantea aurantiaca* Spruce ex Gilg, Bot. Jahrb. Syst. 25, Beibl. 60: 32. 1898. TYPE: Brazil. Amazonas: prope Panuré ad Río Vaupés, *Spruce 2719* (holotype, B destroyed, photographs F, GH, MO, MICH, US; lectotype, selected here, K; isolectotypes, BM, BR, C, E, G, GH, GOET, LE, NY, OXF, P, TCD, W).

Wittmack (1878) cited *Norantea aurantiaca* Spruce ("Msc. in coll. ad n. 2719"), a nomen nudum, as a synonym of *Norantea anomala* considering the Spruce collection to be a "forma juvenilis." Though Wittmack in a note gave a short description of Spruce's collection, it was not his intention to describe or publish a new species. Gilg (1898) was the first to recognize and validly publish *Norantea aurantiaca* Spruce as a separate species, differing from *Norantea anomala* in the inflorescence, the shape, the venation, and the hypophyllous glands of the leaves and in particular the presence of two large hypophyllous glands, one on each side, in the apical part of the blade and some scattered very small ones. Thereupon *Norantea aurantiaca* Spruce became validated, and consequently *Norantea aurantiaca* Spruce ex Gilg is the correct basionym of *Sarcopera aurantiaca*. Bedell (1985) attributed *Norantea aurantiaca* Spruce to Gilg and Werdermann (1925), overlooking the earlier publication of Gilg (1898). Ferreira (1995) was also wrong when she published *Norantea aurantiaca* Spruce ex Ferreira. She erroneously considered *Norantea aurantica* Spruce as used by Gilg (1898) and by Gilg and Werdermann (1925) to be a nomen nudum, since no Latin diagnosis was supplied. This, however, was not required at that time (Art. 36.1 ICBN; Greuter et al., 1994). Because of its

spicate inflorescence this species clearly belongs in *Sarcopera*.

Sarcopera flammifera de Roon & Bedell, sp. nov. TYPE: Brazil. Roraima: Sierra Tepequem, *Maguire & Maguire 40104* (holotype, U; isotypes, MARY not seen, NY). Figure 1.

Frutex vimineus sarmentosus, plerumque scandens vel liana. Folia ramorum floriferorum petiolis 3–10 mm longis; lamina coriacea, elliptica, obovato-elliptica vel interdum elliptico-oblonga, 5–9(–12) cm longa, 2–4.5(–6.5) cm lata, apice obtusa vel rotundata vel raro perbreviter acuminata, basi acuta vel obtusa aut rotundata; glandulae hypophyllae plerumque paucae, variabiles quoad magnitudinem et numerum, nonnunquam nullae, interdum 1–3 conspicuae, dispersae, et aliquot minutae secus marginem dispositae. Inflorescentia spicata multiflora, rhachide (15–)20–35(–45) cm longa, badia; bracteae nectariferae cucullatae vel cochleares, 10–15 mm longae. Flores sessiles; petala elliptica vel elliptico-oblonga, 2.5–4 mm longa, 1.5–2.5 mm lata; stamina 7–10(–13); ovarium 3–4-loculare. Fructus globosus, ad 1 cm diametro.

Scandent sprawling shrub or small liana; branchlets subterete, the older branches with a grayish bark, often with striations of lenticels, the younger ones reddish brown. Leaves coriaceous, dark green above, dull and paler below, when dried grayish, greenish gray, or dark brown colored above, light to dark brown beneath; petiole 3–10 mm long, 1.5–2 mm wide, flattened or canaliculate above; blade elliptic to obovate, 5–9(–12) × 2–4.5(–6.5) cm, basally acute to rounded, apically obtuse to rounded, rarely acute, mucronate when young, retuse after loss of the deciduous mucro; margin revolute; hypophyllous glands varying in number and size, often 1–3 distinct small to medium-sized ones, 1–2 mm diam. with a light-colored circumvallation, mostly only in the apical half, sometimes very minute and only visible with a hand lens or lacking and only the two glands at the base of the midrib present; midvein flat to slightly prominent above, strongly prominent below, lateral veins usually (slightly) prominent below, sometimes obscure. Inflorescence (15–)20–35(–45) cm long, with 100–140 sessile flowers; rhachis 3–5 mm thick at the base, sulcate when dried, dark reddish brown; foliaceous bract ovate, 1 × 0.5 cm, with one pair of hypophyllous glands; nectariferous bracts leathery and succulent, deep red to maroon, ladle-shaped, ca. 1–1.5 cm long, becoming progressively reduced toward the base of the rachis, stalk flattened, widened toward the cup, ca. 8–10 mm long, cup to ca. 5 mm long and ca. 4 mm wide. Flowers leathery, deep red, 3–4 mm diam.; bracteoles triangular to ovate, ca. 1 mm long; sepals sub- to semi-orbicular, ca. 1 mm long, 1–2 mm wide; petals elliptic to elliptic-oblong, 2.5–4 mm long, 1.5–2.5 mm wide, free or slightly connate at base, reflexed at anthesis; stamens 7–10(–13), filaments flattened, 1.5–2 mm long, connate at base and adnate to the petals, anthers triangular-ovate, base cordate, ca. 1 mm long, pollen magenta; ovary ovate-subglobose, ca. 1–1.5 mm long, 3–4-loculed. Fruit dark red to black-purple, globose, 5–10 mm diam.; seeds few, reniform, ca. 2 mm long, black, shining, reticulate.

Distribution. *Sarcopera flammifera* occurs in a variety of habitats (forests, along rivers, rocky slopes, and savannas at altitudes from 100 to 1800 m) in the Caura and Caroní basins of Bolívar state in Venezuela and in northern Brazil.

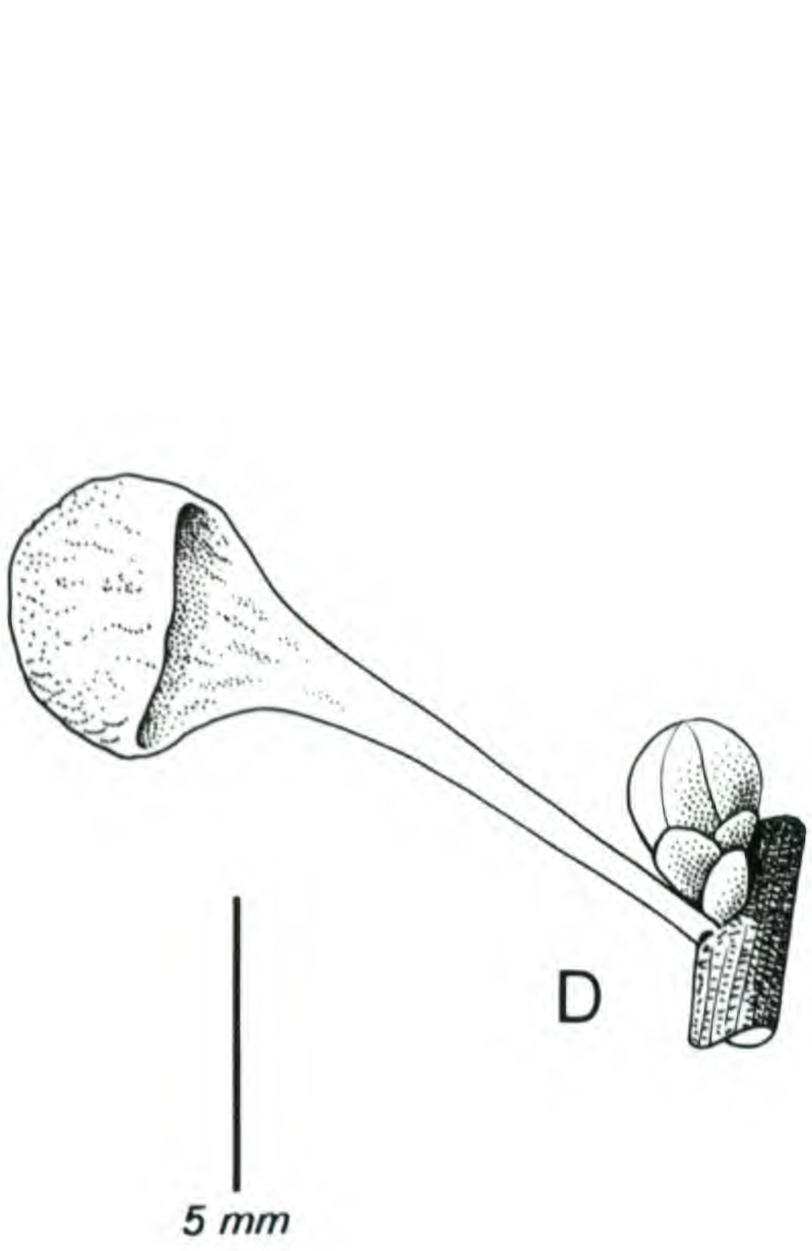
Etymology. The name refers to the blazing inflorescence with its red-colored nectariferous bracts giving the impression of little flames.

The species is distinguished from *Sarcopera tepuiensis*, which is found on tepuis of Bolívar state at altitudes above 1000 m, by its smaller and somewhat less coriaceous leaves, and the lower number of stamens. The species is also related to *Sarcopera aurantiaca* from Colombia and Brazil, from which it is mainly distinguished by the shape of the leaves.

Remarks. Bedell (1985) described the pollen of this species as pale yellow. Indeed in some collections, e.g., *Steyermark 90246* and *113260*, the pollen seems to have this color, but in this and other cases it is doubtful whether the pollen is mature. In some other collections, e.g., *Maguire & Maguire 40151* and *Maguire et al. 53529*, there is no doubt that the pollen is magenta-colored. Therefore we assume that the pollen of *Sarcopera flammifera* has no different color from that of all other species of the genus.

The only known collection of the proposed "*S. atrovinosa*" (Bedell 1985), *Agostini 402* (NY, U, US, VEN), from pequeña meseta del Norte de Serrania Cararubán, SE de Canaima, Bolívar state, appears to be no more than an individual of *S. flammifera* with an unusual leaf shape.

Several collections, e.g., *Holst & Liesner 3127* (MO, NY) and *3384* (MO) from the valley of Río Coro-Coro, W of Serrania de Yutaje, *Maguire & Maguire 35109* (NY, U) from Serrania de Yutaje, Río Manapiare, Caño Yutaje, *Phelps & Hitchcock 3* (NY, VEN) and *Phelps 114* (VEN) from Cerro Yavi, all in northern Amazonas state, and *Steyermark et al. 109410* (NY, US, VEN) from selva de galeria Río Marajano, cumbre de Cerro Jaua in western Bolívar state, collected at altitudes of 650–1800 m, probably belong to *Sarcopera flammifera*, but are different because of larger leaves and the presence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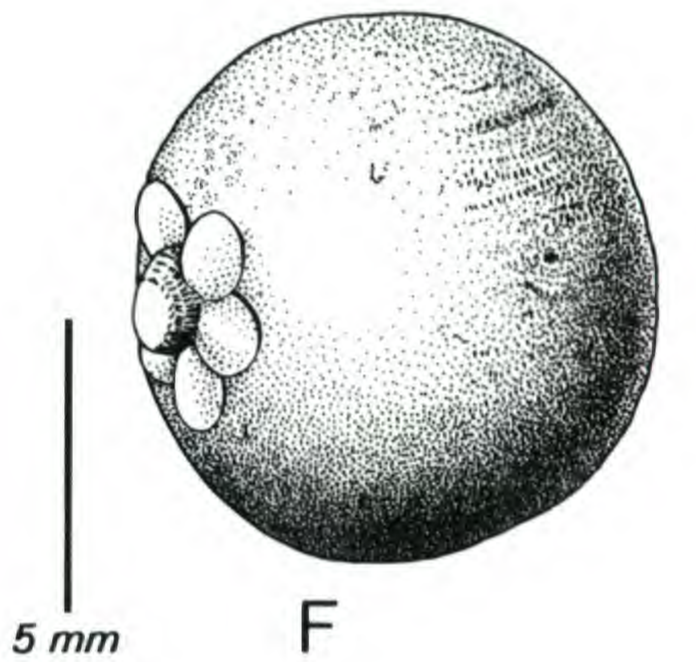
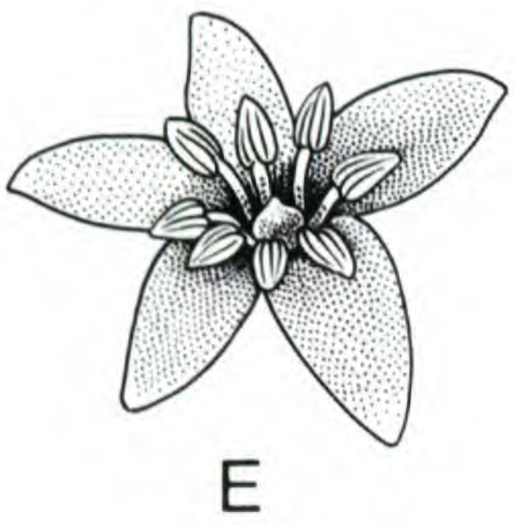
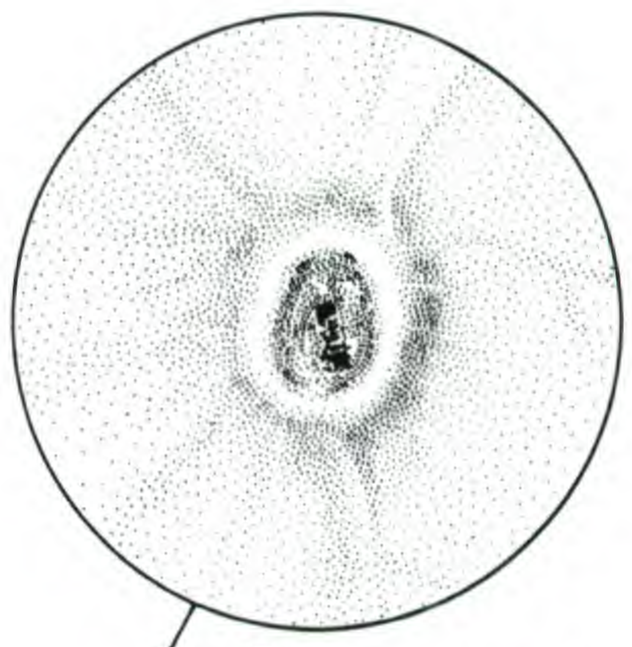
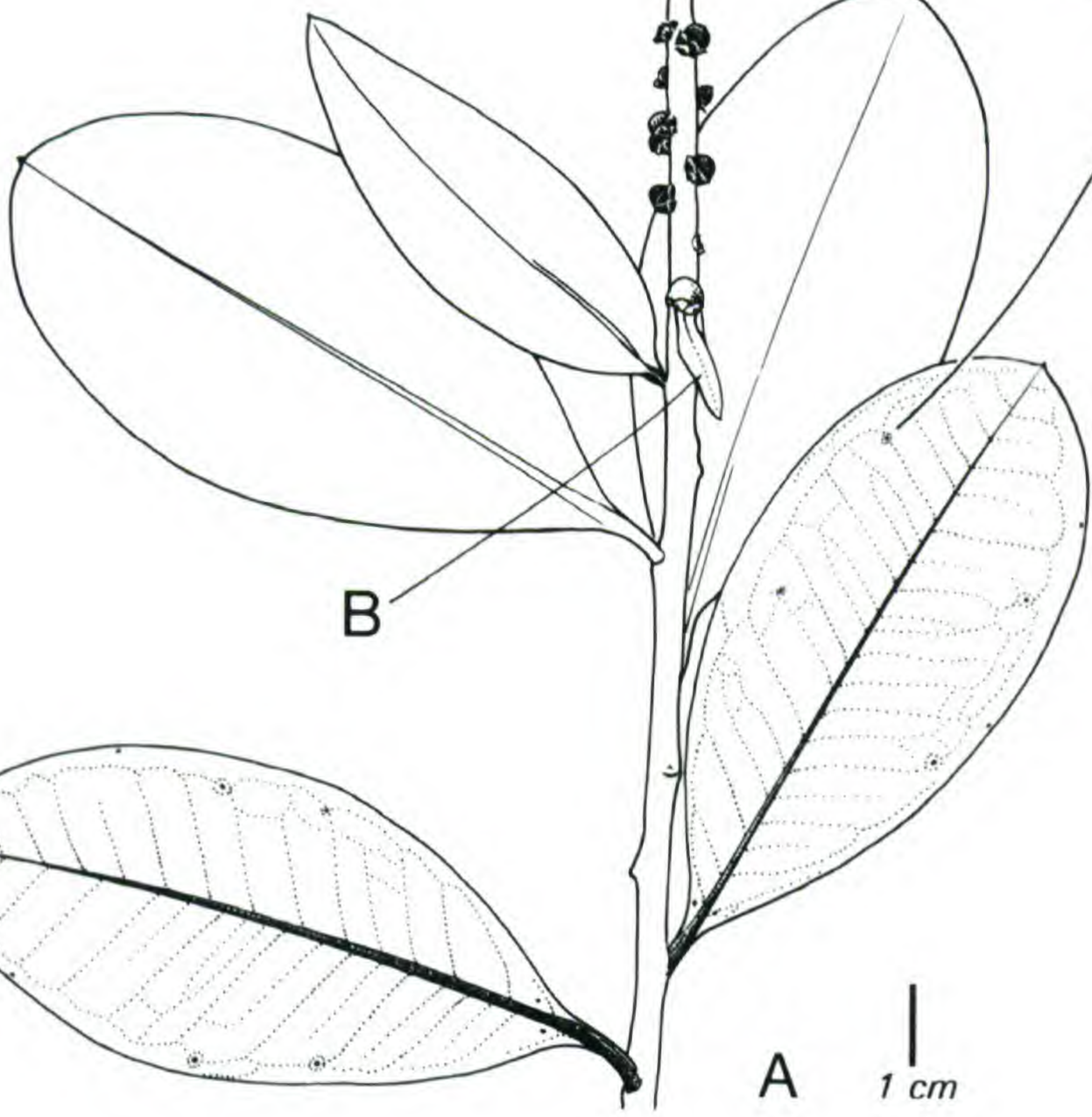

5 mm
F


E


C
r = 1 mm


B

A
1 cm

of rather numerous foliar sclereids. Bedell (1985) wrongly placed some of these collections in her "*Sarcopera coccinea*" (= *Sarcopera tepuiensis* subsp. *coccinea*) from which they are distinguished by the shape of the leaves (obovate vs. oblanceolate) as well as by the number of the stamens (8–12 vs. 15–30). Possibly these specimens belong to an undescribed subspecies of *Sarcopera flammifera*.

Specimens examined. VENEZUELA. **Bolívar:** pequeña meseta del Norte de Serranía Cararubá, *Agostini 402* (NY, U, US, VEN); Cerro Bolívar, Ciudad Piar, *Aristeguieta 2184* (NY, VEN); 2 km de la margen izquierda del medio Río Paragua, 102 km SW de La Paragua, *Aymard 5967* (MO); cerca del Río Cushimí, afluente del Erebato, *Brewer 60* (VEN); Río Caroní, Raudales de Arepuchi, *Cardona 1935* (US, VEN); Río Caroní, Cerro Arepuchi, *Cardona 1940* (NY, US, VEN); Río Carrao, Salto Hacha, *Cardona 2842* (US); Cerro Guaiquinima, *Delascio & Ortiz 14290* (VEN); afluentes mas occidental del Río Carapo, Cerro Carapo, en el cumbre del Guaiquinima, *Duno & Brewer 331* (VEN); Parque Nacional "Canaima," 10 km E of Cerro Venado, 25 km ENE of Canaima, *Duno de Stefano et al. 467* (VEN); Río Chicanán, 2 km S of Río Chibau, *Maguire et al. 53529* (NY, U, VEN); Río Paragua near "Minas de Manaima," *Stergios 10297* (NY, VEN); Sierra Ichún, N of Salto María Espuma along Río Ichún, *Steyermark 90246* (NY, U, US, VEN); Sabana de Cusimi, near Río Cusimi, affluent of Río Erebato, *Steyermark 93162* (NY, U, VEN); Cerro Guaiquinima, Salto del Río Szczerbanari, *Steyermark et al. 113260* (F, MO, U, US, VEN). BRAZIL. **Amazonas:** Serra Aracá, *Rosa & Lira 2287* (U). **Roraima:** Sierra Tepequem, *Maguire & Maguire 40104* (NY, U); Sierra Tepequem, near E escarpment, *Maguire & Maguire 40151* (NY, U); Sierra Tepequem, upper plateau and summit, *Prance et al. 4417* (AAU, K, NY, U).

Sarcopera tepuiensis (de Roon) Bedell, comb. nov. Basionym: *Norantea tepuiensis* de Roon, Acta Bot. Venez. 2: 247. 1967. TYPE: Venezuela. Bolívar: Chimanta Massif, NW slopes of Churi-tepui (Muru-tepui), along Río Sarrén, *Wurdack 34353* (holotype, U; isotypes, MARY not seen, NY, US).

Sarcopera tepuiensis subsp. **coccinea** de Roon & S. Dressler, subsp. nov. TYPE: Venezuela. Amazonas: Cerro Yapacana, *Maguire et al. 30687* (holotype, U; isotype, NY).

A subsp. *tepuiensis* differt foliis plerumque oblanceolatis glandulis hypophyllis parvis numerosis biseriatis.

Liana to 30 m or erect to sprawling shrub or tree to 10 m tall; older branches grayish, the younger ones reddish brown. Leaves coriaceous, dark dull green above, paler below, when dried greenish to yellowish brown or dark brown above and light to dark brown below; petiole rather stout, 0.5–2 cm long, ca. 3 mm wide; blade obovate-oblong to oblanceolate, 8–22 × 3.5–7.5 cm, basally acute to cuneate, apically obtuse or rounded, mucronate when young, afterward often retuse, margins slightly revolute, hypophyllous glands small, to 0.5 mm diam., with a minute pore, 2 at the base near the midrib and 5–8 in an often irregular row at ca. 5 mm from the margin in the middle of the leaf and closer to the margin toward the top. Inflorescence 30–50 cm long with 130–155 sessile flowers; rachis stout, 5–7 mm diam. at the base, longitudinally grooved and yellowish to reddish brown or dark brown when dried; foliaceous bract elliptic, ca. 2.5 cm long, 0.5–1 cm wide, with 1–2 pairs of hypophyllous glands; nectariferous bracts succulent, bright red, ladle- to helmet-shaped, fully developed in the upper part of the rachis, becoming smaller to wholly reduced to the base, 1–1.5 cm long, the cup 3–5 mm long, ca. 5 mm wide, the stalk flattened, 5–10 mm long, inserted at the base of the flowers. Flowers sessile, leathery, bright red; bracteoles ± deltoid, 0.5–1 mm long, to 1.5 mm wide; sepals broadly suborbicular, ca. 1 mm long, 1–2 mm wide; petals oblong, 3–5 mm long, ca. 2 mm wide; stamens (15–)20–25(–30) in two or sometimes three whorls; filaments flattened, connate for ½–¾ of their length, ca. 2 mm long, in the outer row longer than in the inner row, and adnate to the petals; anthers triangular to ovate, cordate-sagittate at base, ca. 1.5 mm long, pollen magenta; ovary ovate or ovate-conical, 1–2 mm long, 1–1.5 mm diam., 3-loculed with 6–8 ovules per locule. Fruit dull red, ca. 1 cm diam.; seeds reniform, ca. 2 mm long, shining, reddish black.

Distribution. *Sarcopera tepuiensis* subsp. *coccinea* occurs on several tepuis of Amazonas state in Venezuela, at altitudes of 1000–1400 m.

Etymology. The name refers to the bright scarlet nectariferous bracts.

The differences between *Sarcopera tepuiensis* subsp. *tepuiensis* and subspecies *coccinea* are mainly in the shape of the leaves and the number of the hypophyllous glands. In subspecies *coccinea* the leaves are oblong-obovate to oblanceolate with two

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Figure 1. *Sarcopera flammifera* de Roon & Bedell. —A. Flowering branch. —B. Foliaceous bract. —C. Hypophyllous gland. —D. Nectariferous bract. —E. Flower. —F. Fruit with persistent sepals. (A–D from *Maguire 40104*; E from *Steyermark 93162*; F from *Prance et al. 4417*.)

glands at the base and two rows of 5–8 small hypophyllous glands along the margin, while subspecies *tepuiensis* has obovate to oblong-obovate leaves with two glands at the base and usually only 1–2 hypophyllous glands per side. In our estimation these differences are considered too variable to distinguish the two taxa as separate species.

The two subspecies of *Sarcopera tepuiensis* occupy separate geographic areas: subspecies *coccinea* is known from mountains in southern Amazonas state in Venezuela and from Serra Araca in adjacent Brazil; subspecies *tepuiensis* is known from over 25 collections from the tepuis of eastern Bolívar state in Venezuela and the Pakaraima Mts. in adjacent Guyana. Most collections of both subspecies are from above 1000 m.

Paratypes. VENEZUELA. **Amazonas:** Cerro Duida, *Fariñas et al. 438* (NY, U, VEN); Serranía Parú, Cerro Asisa, near laguna Asisa, *Hoyos & Morillo 95 [herb. 96222]* (VEN); Cerro Marahuaca, above Río Yameduaka, *Liesner 17679* (MO); Cerro Marahuaca, N of Sima Camp, *Liesner 18477* (MO, VEN); Cerro Yapacana, *Maguire et al. 30630* (NY), *30687* (NY, U); Cerro de la Neblina, Río Yatua, Caño Grande, *Maguire et al. 42514* (MO, NY, U); Cerro Yapacana, *Steyermark & Bunting 103167* (MO, NY, U, VEN); Cerro Marahuaca, Sima Camp, Caño Negro, *Steyermark & Holst 130479* (VEN). BRAZIL. **Amazonas:** Serra Araca, plateau of northern massif, *Prance et al. 29030* (K, NY).

Marcgraviastrum pendulum (Lanjouw & van Heerdt) Bedell, comb. nov. Basionym: *Norantea pendula* Lanjouw & van Heerdt, Recueil Trav. Bot. Néerl. 37: 282. 1940. TYPE: Suriname. Emmagebergte, 700 m, *B. W. 5682* (holotype, U).

The leaves with a dense tangle of foliar sclereids, the umbelliform inflorescence, and the large flowers with over 50 stamens are the convincing characters to place this species in *Marcgraviastrum.*

Distribution. The species is known from mountains in Guyana, Suriname, French Guiana, and eastern Venezuela. A representative collection from the region is from Bolívar state: Alto Río Cuyuni, Río Uiri-yuk, *Maguire et al. 46979* (U, VEN).

Acknowledgments. We are indebted to the curators of the herbaria of which material was available for our study. We thank Hendrik Rypkema for drawing the illustration, Lubbert Westra for helping with the Latin diagnoses and the English text, and Gea Zijlstra for her advice regarding nomenclature. We are also grateful to Paul Berry for valuable hints, which improved the manuscript.

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A New Species of *Elvasia* (Ochnaceae) from Mesoamerica with Discussion of Subgeneric Classification and Phytogeography

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ABSTRACT. A new species of *Elvasia*, *E. bisepala*, is described from Belize and Honduras. *Elvasia bisepala* possesses unique characters that help to clarify subgeneric classification in the genus and further expands the distribution of *Elvasia* from South America well into Central America. The new species is described and illustrated, and the subgeneric classification of *Elvasia* is reviewed and revised.

The genus *Elvasia* has previously been considered to be exclusively South American and concentrated in the Amazon basin and the Guianas (Sastre & Lescure, 1978; Sastre, 1987), with a single species occurring in Bahia, Brazil (*E. tricarpellata* Sastre), and another recently collected in Panama and Costa Rica (*E. elvasioides* (Planchon) Gilg; pers. obs.). Currently there are 11 (including the new species described here) accepted species in the genus, which is distinguished from the rest of the Ochnaceae in the Neotropics by the uniovulate carpels that are united in fruit. During a review of material for the preparation of the Ochnaceae account for *Flora Mesoamericana*, a distinctive new species of *Elvasia* was found among recent collections from Belize and Honduras. The discovery of this taxon has clarified some previously ambiguous points about the infrageneric classification and biogeography of the genus.

Infrageneric classification in *Elvasia* has been based primarily on either stamen number and ovary morphology or fruit characteristics. Planchon (1846) divided the genus into two subgenera: subg. *Euelvasia* Planchon with 8 stamens and a 4-locular ovary, and subg. *Hostmannia* Planchon, with 18–20 stamens and a bilocular ovary. This same basic division was followed in Engler (1876). Van Tieghem (1902) elevated the genus to the rank of subfamily, and divided it into two tribes using fruit characteristics, the Elvasieae with star-shaped fruits and the Hostmannieae without star-shaped fruits. Gilg (1893, 1925) more or less followed earlier floral-morphology-based schemes in dividing the genus into two sections: sect. *Euelvasia* with 8 stamens (including *E. calophyllea* DC. & *E. quinqueloba* Spruce ex Engler) and sect. *Hostmannia* with 18–20 stamens (including *E. hostmannia* (Planchon) Gilg & *E. essequibensis* Engler).

Revising the genus throughout its range, Dwyer (1943) described three sections based on various combinations of ovary locule and stamen number: sect. *Euelvasia* with 7–10 stamens and a 4–5-locular ovary (*E. calophyllea*, *E. quinqueloba*, and *E. canescens* (Van Tieghem) Gilg), sect. *Eussequibensa* Dwyer with 10–20 stamens and a 4–5-locular ovary (*E. essequibensis* and *E. brevipedicellata* Ule), and sect. *Hostmannia* with variable numbers of stamens and a bilocular ovary (*E. elvasioides* (Planchon) Gilg and *E. caurensis* Pittier). Cowan (1952) described *E. sphaerocarpa*, which he postulated was closely related to *E. essequibensis*. Due to its globose, unlobed fruit, he erected a new section for it, section *Conjunctipora* Cowan. Additional new species (Cuatrecasas, 1950; Sastre & Lescure, 1978) can be accommodated in Dwyer's subgeneric classification, with both *E. macrostipularis* Sastre & Lescure (closely related to *E. sphaerocarpa* but with only 2 carpels) and *E. oligandra* Cuatrecasas being placed in section *Hostmannia*.

Placement of *Elvasia tricarpellata* Sastre (Sastre, 1981), with its 3-carpellate ovary and 10–15 stamens, in Dwyer's classification is problematic. With the discovery of *E. bisepala*, described here, a simpler and less ambiguous subgeneric classification of the genus *Elvasia* can be proposed with two sections: section *Elvasia* (= *Euelvasia*), characterized by star-shaped fruits, and section *Hostmannia* (Planchon) Gilg, characterized by globular fruits. The component species in each section, with their

Table 1. Subgeneric classification and distribution of taxa in *Elvasia* (Ochnaceae).

Subgenus	Species	Distribution
Elvasia	*E. calophyllea* DC.	Colombia (Vaupes), Brazil (along the Rio Negro), Guyana
	E. quinqueloba Spruce ex Engler	Colombia (Río Guainia), Brazil (along the Rio Negro)
	E. canescens (van Tieghem) Gilg	Venezuela (upper Rio Orinoco), Brazil (along the Rio Negro and Rio Xingu)
	E. essequibensis Engler	Guyana
Hostmannia (Planchon) Gilg	*E. elvasioides* (Planchon) Gilg	Venezuela (Amazonas, Bolívar), Suriname, French Guiana, Brazil (Pará), Panama, Costa Rica
	E. oligandra Cuatrecasas	Colombia (Norte de Santander)
	E. macrostipularis Sastre & Lescure	French Guiana, Brazil (Amapá, Pará)
	E. sphaerocarpa Cowan	Guyana
	E. bisepala Sastre & Whitefoord	Belize, Honduras
	prov. *E. tricarpellata* Sastre	Brazil (Bahia)

geographic distributions, are presented in Table 1. Two species are not placed with certainty in the current subgeneric classification: *E. brevipedicellata*, of which the type at B was destroyed (the species is known only from photographs of this type), and *E. tricarpellata*, which is placed provisionally in section *Hostmannia* due to the overall similarity of its young fruits to those of *E. bisepala*. It is clear that section *Elvasia* is fundamentally Amazonian, while section *Hostmannia* is more or less circum-Amazonian and Central American.

Elvasia bisepala Sastre & Whitefoord, in Sastre, Whitefoord & Knapp, sp. nov. TYPE: Belize. Toledo District: Maya Mountains, lower part, Richardson Creek (lower part), affluent of Bladen Branch, 88°46–48′W, 16°33′N, short semi-deciduous dry forest along stream, 100–250 m, 2, 3, 11 Mar. 1987 (fl), *Davidse & Brant 32340* (holotype, BM; isotypes, BFD, MO, P). Figure 1.

Ab *E. tricarpellata* Sastre foliarum laminis minoribus (6–13 × 2.5–4 cm vs. 8–18 × 4–6 cm), inflorescentiis minoribus (7–9 cm vs. 6–20 cm longiore) et sepalorum numero 2 vs. 3–4 differt.

Trees 6–10 m tall, branches glabrous. Leaves 6–13 × 2.5–4 cm, elliptic to narrowly elliptic, coriaceous, principal vein prominent abaxially, sharply keeled adaxially, the secondary veins fine and parallel, perpendicular with the principal vein; base cuneate or sometimes attenuate, margin with minute, glandular, black teeth, appearing undulate when dry, the apex acuminate; petiole 3–6 mm long; stipules 1.5–3.5 mm long, triangular, entire or apparently trifid with a stouter central division, appearing tattered and laciniate with age. Inflorescence paniculate, terminal on short stems, 7–9 cm long with 1–5 branches, the branches 2.5–4 cm long, minutely pubescent; bracts similar to the stipules, 1–2.5 mm long, triangular, at branch points and at the base of the flowers; pedicel 4–7 mm long, articulate near the base, very shortly pedunculate. Flowers solitary or occasionally clustered in groups of 2–3, with the sepals 2 (rarely 3), ca. 4 mm diam., subcircular, coriaceous; petals 3–4(–5), 5–5.5 × 4.5 mm, ovate to obovate, membranous, a few somewhat coriaceous at the base; stamens 9–14, the filaments ca. 1.5 mm long, the anthers ca. 2.5 mm long, dehiscence porose; ovary depressed-globular, tricarpellate; style single, (2–)3–4 mm long. Fruit 1–2-loculate by abortion, subglobular, 8–10 mm diam., leathery (?), the style base persistent.

Distribution. In semi-deciduous forests in Belize and adjacent Honduras, 100–350 m.

Elvasia bisepala differs from *E. tricarpellata* in its smaller leaf blades (6–13 × 2.5–4 cm vs. 8–18 × 4–6 cm), smaller inflorescences (7–9 cm vs. 6–20 cm long), the number of sepals (2 (rarely 3) vs. consistently 3–4) and its Central American distribution. Its globular fruit places *Elvasia bisepala* in section *Hostmannia* (see above, Fig. 1).

Paratypes. BELIZE. **Toledo District:** Maya Mountains S., Bladen Nature reserve, Ek Xux canyon, 16°30′N, 88°55′W, forested canyon bottom with large exposed boulders, 320 m, 18 May 1996 (fl, young fr), *Davidse 36088* (BM, MO, P), 18 May 1996 (fl), *Davidse 36096* (BM, MO, P), 20 May 1996 (fr), *Davidse 36164* (BM, MO, P). HON-

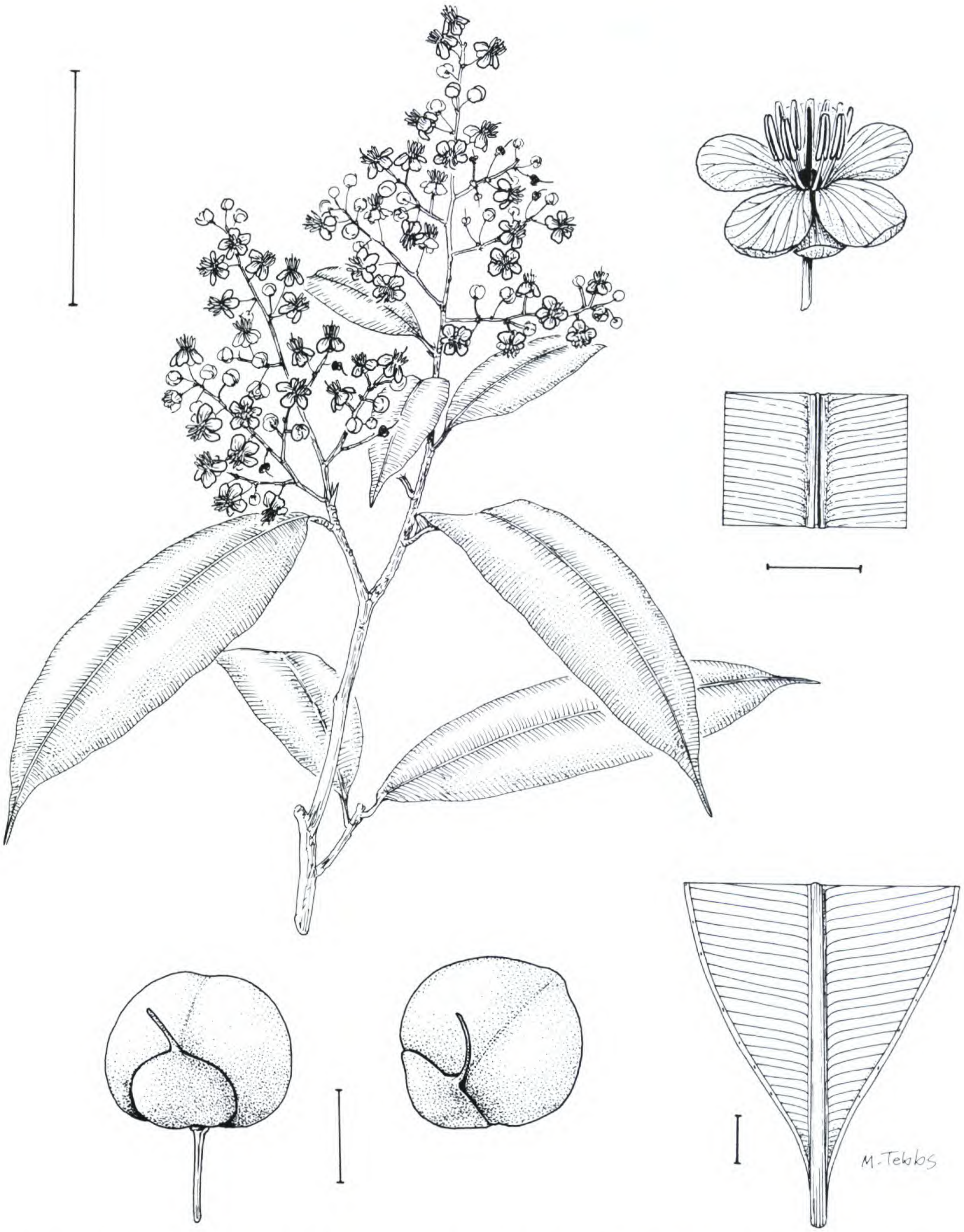

Figure 1. *Elvasia bisepala* Sastre & Whitefoord, from *Davidse & Brant 32340* (BM), with details of flower and fruit. Scale bar in upper left = 5 cm, all others = 5 mm.

DURAS. **Atlántida:** Pico Bonito, base of N, E of new CURLA (Centro Universitario Regional del Littoral Atlantico), 15°42′N, 86°50′W, upland primary forest on slope, 300 m, 14 May 1993 (fr), *Evans 1663* (MO).

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A New Species of *Pilocarpus* Vahl (Rutaceae) from Peru

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ABSTRACT. A new species of *Pilocarpus* Vahl (Rutaceae) from Peru is described and illustrated as *Pilocarpus manuensis* Skorupa. The new taxon is known only from the type locality in Parque Nacional Manu, Peru, and resembles *Pilocarpus demerarae* Sandwith from Guyana.

Pilocarpus is a Neotropical genus of arborescent and shrubby plants, ranging from southern Mexico to southern South America. Throughout its geographic range it may be found in various habitats, such as the moist Atlantic Forest or dry Caatinga in Brazil. In a recent revision of the genus (Skorupa, 1996) 16 species were recognized, including 3 new species from Brazil (Skorupa, 1998) and 1 from Peru. The purpose of this paper is to describe this new Peruvian species.

Pilocarpus manuensis Skorupa, sp. nov. TYPE: Peru. Madre de Dios: Manu, Parque Nacional Manu, Pakitsa Station, trails to N and NE of camp, 11°56′S, 71°16′W, 350 m, 13 Sep. 1989, *R. B. Foster & H. Beltran 13183* (holotype, NY; isotypes, F, MO). Figure 1A–C.

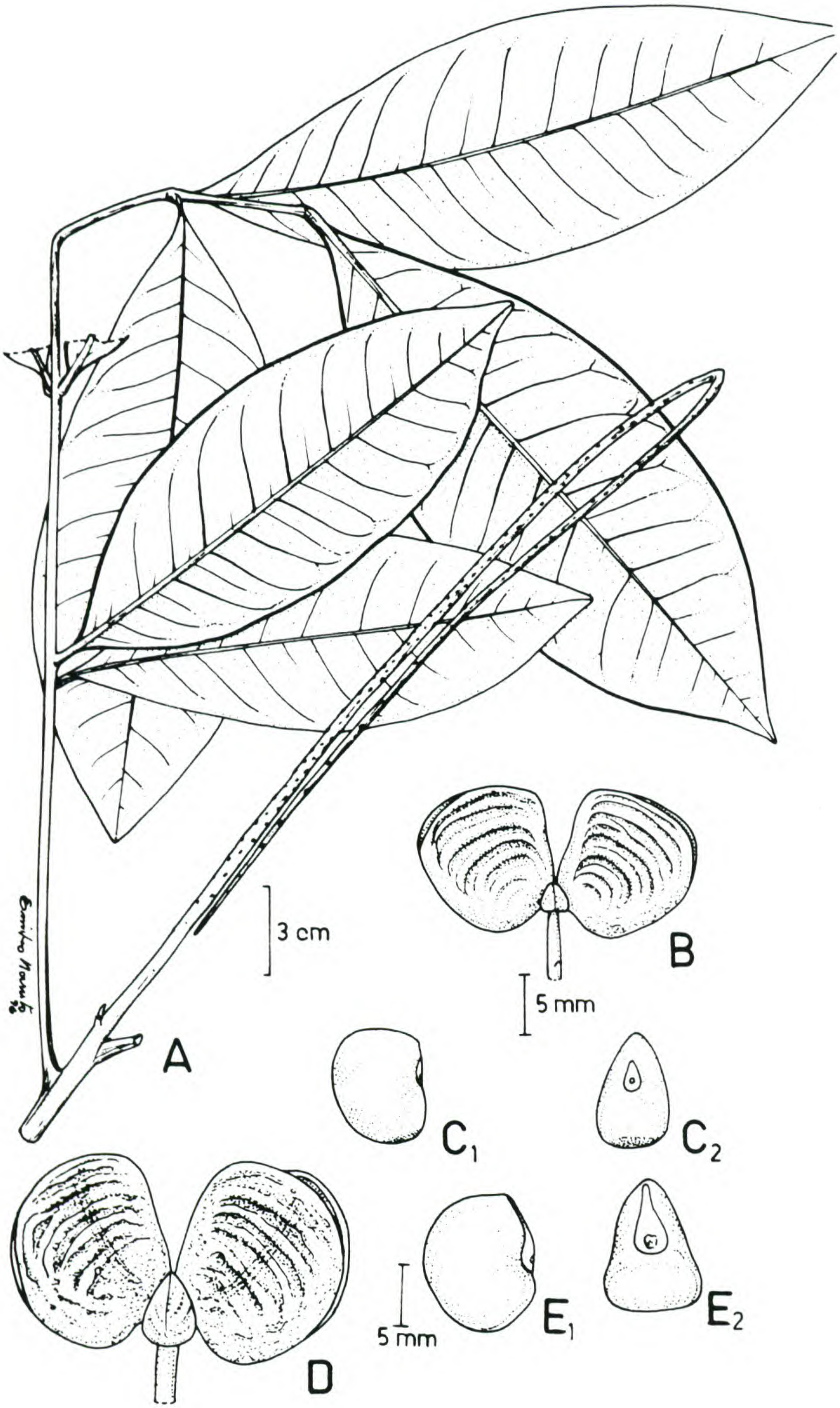
Folia imparipinnata; lamina elliptica vel anguste elliptica, apice acuminato; fructus ex 1–3 coccis constans, cocci 12.0–12.5 × 11.0–12.0 mm; seminibus vinaceis quasi nigris, ca. 10.0 × 8.0 mm, hilum ovatum et planum, ca. 3.0 × 1.8 mm. Flores non vidi.

Small tree, reported as 3.0 m tall; terminal branchlets 7.0 mm diam., pale brown, glabrous. Leaves imparipinnate, 3-jugate, alternate, ca. 45.0 × 42.0 cm, distance between pairs 9.0–9.5 cm, the rachis ca. 23.0 cm × 3.0–3.5 mm, continuing beyond the upper pair of leaflets ca. 4.0 cm, glabrous, slightly canaliculate near the leaflets, slightly winged, the wings 0.3–0.5 mm broad, glabrous; petiole inserted at ca. 40°, 13.0–13.5 cm × ca. 3.5 mm, glabrous, slightly canaliculate near the first pair of leaflets, slightly winged, the wings ca. 0.3 mm; lateral leaflets subopposite, the lowermost alternate; the blade shining green above, pale beneath, chartaceous, slightly bullate among secondary veins, glabrous, 18.3–21.0 × 7.5–7.8 cm, narrowly elliptic to elliptic, acute to acuminate at apex, acumen to 15.0 mm, base slightly asymmetric, attenuate, the margin revolute, entire or slightly undulate; venation brochidodromous, the midvein plane on adaxial surface and prominent on abaxial surface, secondary veins 14–16 pairs, slightly prominent on adaxial surface, prominent on abaxial surface, angle of divergence ca. 65°; petiolule 2.0–4.0 × 2.0–2.5 mm, inserted at 50–60°, glabrous, slightly winged, the wings ca. 0.3 mm broad, slightly canaliculate near wings; terminal leaflet blade 22.5 × 8.5 cm, narrowly elliptic, acuminate at apex, asymmetric and attenuate at base. Raceme terminal, erect, to 55.0 cm long and 3.0–3.5 mm wide in fruit, greenish brown, glabrous; bracts at base 5.0–6.0 mm long, triangular to oblong, pubescent near apex or glabrous; calyx 5-toothed, teeth unequal, 0.2–0.6 × 0.5–1.0 mm, ovate to triangular, rounded at apex, glabrous, ciliolate; bractlets 2, ovate with subacuminate apex, glabrous, ciliolate, alternate and inserted near middle of the pedicel. Mericarps 1–3, 12.0–12.5 × 11.0–12.0 mm, obovoid, slightly rounded at apex, pale brown becoming dark, glabrous, conspicuous brown glands becoming dark, line of dehiscence reaching to ¼–⅓ of distance from apex, pedicels 6.5–9.5 mm long in fruit, glabrous; seeds ca. 10.0 × 8.0 mm, obovoid, testa vinaceous to black, the hilum ca. 3.0 × 1.8 mm, ovate and plane. Flowers not seen.

Phenology. Fruiting specimens collected in September.

Distribution. Known only from the type locality in Parque Nacional Manu, southeastern Peru, in forested high terrace and ravine slopes.

Despite the lack of flowering material, the new taxon is distinguished easily from other species of the genus by characters of its vegetative branches, mericarps, and seeds. *Pilocarpus manuensis* resembles *Pilocarpus demerarae* Sandwith because of its compound leaves with a rachis somewhat biarticulate near the apex and its narrowly elliptic to elliptic leaflets with an acuminate apex and a bullate blade. The two taxa may be separated, however, by features of their mericarps and seeds. *Pilocarpus manuensis* has obovoid mericarps with a short line of dehiscence (¼ to ⅓ of distance from apex),


3 cm
A
B
5 mm
C1
C2
D
5 mm
E1
E2

whereas *P. demerarae* has ovoid to ellipsoid mericarps, larger (14.5–16.0 × 12.5–13.5 mm) and with a line of dehiscence more accentuated (⅔ to ¾ of distance from apex) (Fig. 1D). The larger (11.0–12.0 × ca. 9.0 mm), ovoid to ellipsoid seeds of *P. demerarae* also have a remarkable hilum (5.0–5.8 × 2.5–3.0 mm) that is conspicuously recurved toward the apex (Fig. 1E), whereas the seeds of *P. manuensis* have a plane, not recurved hilum (Fig. 1C). The two species are allopatric in distribution, the new one known only from Guyana.

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Figure 1. A–C. *Pilocarpus manuensis* Skorupa (*R. B. Foster & H. Beltran 13183*, NY). —A. General aspect of the branch. —B. Mericarps, lateral view. —C_1 and C_2. Seed, lateral and ventral view. D, E. *Pilocarpus demerarae* Sandwith (*D. B. Fanshawe 5610*, K). —D. Mericarps, lateral view. —E_1 and E_2. Seed, lateral and ventral view.

New Names, a New Combination, and a New Species of *Psychotria* (Rubiaceae: Psychotrieae) from São Paulo State, Brazil

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ABSTRACT. The new species *Psychotria leitana* C. M. Taylor is described, the combination *Psychotria subspathulata* (Mueller Argoviensis) C. M. Taylor is made based on *Mapouria subspathulata* Mueller Argoviensis, and the new names *Psychotria ararum* C. M. Taylor, for *Palicourea glaziovii* Standley, and *Psychotria setulifera* C. M. Taylor, for *Palicourea hispidula* Standley, are provided.

During study of *Psychotria* L. (Rubiaceae: Psychotrieae) for the "Phanerogamic Flora of São Paulo State" project, the following new species and nomenclatural needs were discovered. The subgeneric classification of *Psychotria* and its separation from *Palicourea* Aublet have been outlined previously (Taylor, 1996). Standley's reason for naming *Palicourea glaziovii* Standley and *Palicourea hispidula* Standley in *Palicourea* rather than *Psychotria* is not clear, except he noted that the corollas in bud were rather enlarged at the base. He also noted that no other characteristics of the corollas of these species were evident; with better material now available, the corollas of both species can be seen to lack both the swollen base and the internal ring of pubescence near this base that distinguish *Palicourea*. Within *Psychotria*, these species belong to subgenus *Heteropsychotria* Steyermark.

Psychotria ararum C. M. Taylor, nom. nov. Replaced name: *Palicourea glaziovii* Standley, Publ. Field Columbian Mus., Bot. Ser. 8: 217. 1930, not *Psychotria glaziovii* Mueller Argoviensis, in Martius, Fl. bras. 6(5): 267. 1881. TYPE: Brazil. Rio de Janeiro: Serra das Araras, 1888, *A. Glaziou 17033* (holotype, B destroyed; isotypes, BR, P not seen, fragment F-970563).

This species is now also known from the Atlantic coastal forest in southeastern São Paulo State and may be expected in the region between there and the type locality.

Psychotria leitana C. M. Taylor, sp. nov. TYPE: Brazil. São Paulo: mpio. de Ubatuba, Picinguaba, Trilha do Morro do Corsario, 26 Aug. 1991, *R. Romero & N. Roque 354* (holotype, IAC 34744; isotype, HRCB). Figure 1.

Haec species a *Psychotria nemorosa* Gardner stipulis elobatis, pedunculo 4–20 mm longo, panicula 1–3.5 cm longa, pedicellis sub anthesi usque ad 1 mm longis atque tubo corollino 3.5–4 mm longo distinguitur.

Shrubs or small trees flowering at 1 m tall, to 3 m tall; stems flattened becoming subterete, glabrous or densely puberulous to short-pilosulous. *Leaves* with *blades* elliptic, 7–13 cm long, 2.2–5.5 cm wide, at apex acuminate with slender tips 1–1.5 cm long, at base cuneate to obtuse, papyraceous to thinly so, on adaxial face glabrous, on abaxial face densely puberulous to short-pilosulous; secondary veins 4–8 pairs, looping to clearly interconnect near margins, with 2–4 rather weak intersecondary veins present between pairs of secondary veins, without domatia, on adaxial face venation plane, on abaxial face costa, secondary veins, and reticulated minor venation all prominulous; margins entire; *petioles* 5–12 mm long, glabrous to densely puberulous or short-pilosulous; *stipules* persistent, glabrous or densely puberulous to short-pilosulous, united around the stem into a continuous sheath, this entire, 0.8–2.5 mm long, truncate to broadly rounded, with age becoming indurate and occasionally splitting into two deltoid lobes. *Inflorescences* densely puberulous to short-pilosulous, terminal, peduncles 4–20 mm long, sometimes articulated with the articulation bearing a reduced leafless stipule that terminates a basal internode 3–5 mm long; panicles corymbiform-rounded to depressed-corymbiform and nearly flat-topped, 1–3.5 × 2–8 cm, with secondary axes 2–4 pairs, often subverticillate or irregularly distributed along the primary axis, dichotomously branched 1–2 times with the resulting minor axes becoming rather secund; bracts lacking or narrowly triangular, to 0.8 mm long, and rather irregularly distributed, never present at junction of secondary axes; *flowers* sessile or with pedicels to 1 mm long, borne in open cymules of 5–11; hypanthium cupuliform to cylindrical, densely puberulous; *calyx limb* densely puberulous, 0.5–0.8 mm long, lobed for ¼–⅓, lobes deltoid to rounded; *corolla* infundibuliform, cream-colored, externally densely puberulous becoming glabrescent at anthesis, tube 3.5–4 mm long, ca. 1.2 mm diam. near middle, lobes 4–5, triangular, ca. 1.5 mm long, acute. *Infructescences* similar to inflo-

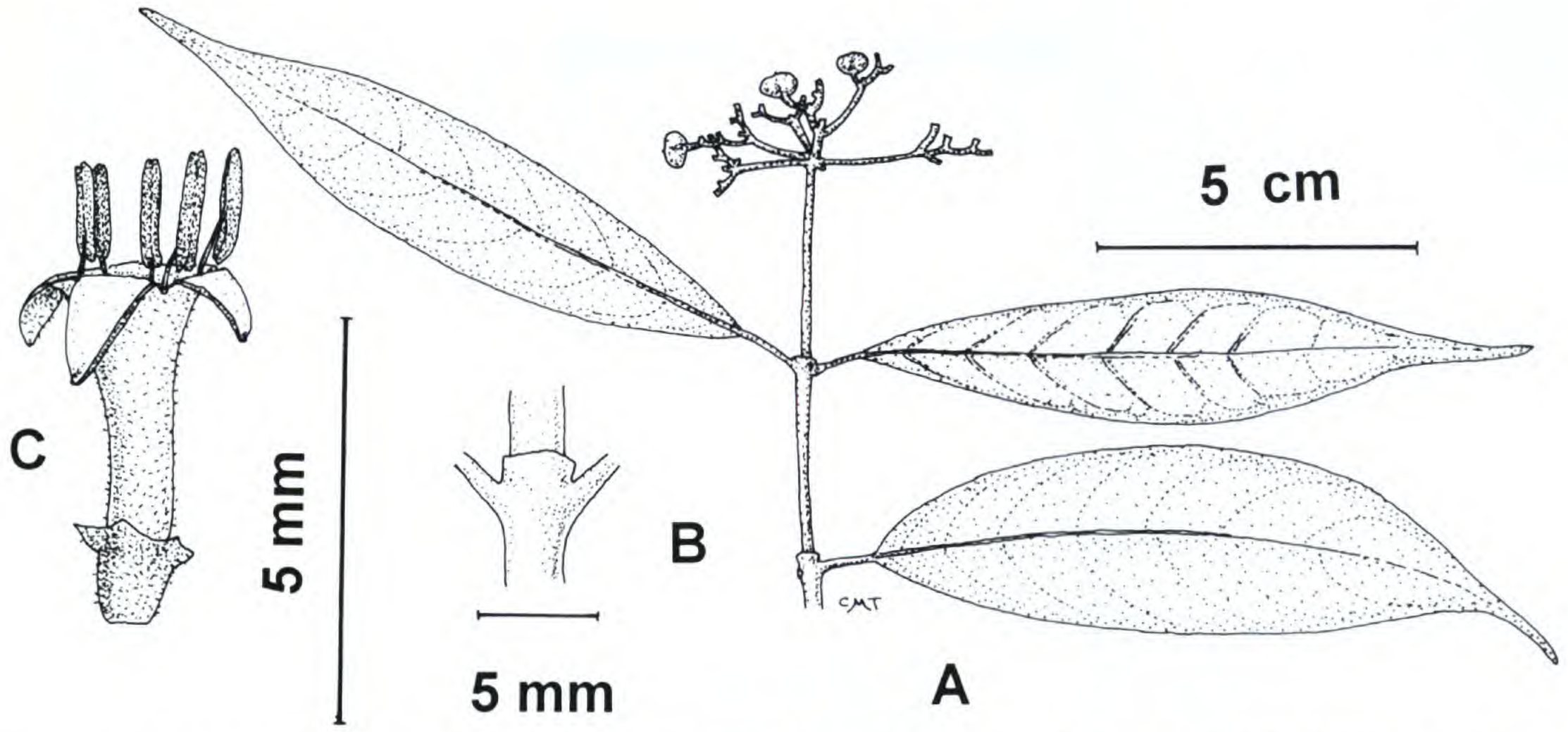

Figure 1. *Psychotria leitana* C. M. Taylor. —A. Flowering branch; based on *de Assis et al. 348* (UEC). —B. Stipule. —C. Flower. B, C, based on *Tamashiro et al. 18738* (UEC).

rescences except pedicels becoming up to 2 mm long; *fruits* broadly ovoid, 3.5–4 × 6 mm, becoming purple, laterally flattened; pyrenes 2, with 3–5 planar angles or weak, rounded, longitudinal ridges.

Southeastern Brazil (São Paulo State), in pluvial Atlantic coastal forest. Collected in flower in February, March, August, and October, in fruit in January, February, September, and November.

This new species belongs to subgenus *Heteropsychotria* and is distinguished by its unlobed stipule sheath, leaves with the venation reticulated and prominulous on the abaxial surfaces, corymbiform inflorescences with the branches becoming rather secund especially as the fruits develop, sessile to shortly pedicellate flowers, and funnelform corollas with tubes 3.5–4 mm long. *Psychotria leitana* has been confused with *P. nemorosa* Gardner; the latter species can be distinguished by its stipules with a truncate sheath bearing clearly developed triangular lobes, inflorescences with peduncles 1.5–3 cm long, panicles 4–10 × 4.5–15 cm, pedicels 1–5 mm long, and corollas with tubes 5–8 mm long.

The specific epithet honors the late Hermogenes Leitão, a productive collector and student of São Paulo State's unusual flora.

Paratypes. BRAZIL. **São Paulo**: mpio. Bertioga, estrada Bertioga–Mogi das Cruzes, *Tamashiro et al. 18738* (UEC); mpio. Iguape, Estação Ecológica Juréia-Itatins, Serra da Juréia, trilha para a Figueira Grande, *Anunciação & Rossi 374* (MO, SP); mpio. Iguape, Estação Ecológica Juréia-Itatins, Serra da Juréia, trilha em direção a Fazenda do rio Verde, *Anunciação et al 633* (MO, SP); mpio. Ubatuba, Estrada de Itamambuca, Km 35 da Rodovia Rio/Santos, *Assis et al. 348* (HRCB); Ilha de São Sebastião, 23°18′S, 46°57′W, *Collares 13* (RB); mpio. Ubatuba, Picinguaba, Estrada da Casa da Farinha, *Furlan et al. 627* (HRCB), *779* (HRCB), *Garcia et al. 140* (HRCB), *Ribeiro et al. 476* (IAC), *Romero et al. 93* (HRCB); mpio. Ubatuba, Picinguaba, Trilha do Morro do Corsário em direção ao mangue, *Ribeiro et al. 439* (IAC); mpio. Ubatuba, 20 Jan. 1997, *Gajardo s.n.* (IAC-34737), 17 Feb. 1997, *Gajardo s.n.* (IAC-34738).

Psychotria setulifera C. M. Taylor, nom. nov. Replaced name: *Palicourea hispidula* Standley, Field Mus. Nat. Hist., Bot. Ser. 11: 227. 1936, not *Psychotria hispidula* Standley ex Steyermark, Acta Bot. Venez. 4: 97. 1964. TYPE: Brazil. Rio de Janeiro: Environs de Rio de Janeiro et D'Ouro Preto, 1883–1884, *A. Glaziou 14900* [holotype, K not seen, photo (F neg. #49916) F].

This species was apparently combined with *Psychotria leiocarpa* Chamisso & Schlechtendal by Mueller. These species can be distinguished by their pedicels, 1.5–7 mm long in *P. leiocarpa* vs. 2–10 mm long in *P. setulifera*. The minor venation on the abaxial leaf surface is hardly evident and plane in *P. leiocarpa* but is clearly evident, closely reticulated, and prominulous in *P. setulifera*.

Psychotria subspathulata (Mueller Argoviensis) C. M. Taylor, comb. nov. Basionym: *Mapouria subspathulata* Mueller Argoviensis, Flora 59(29): 465. 1876. TYPE: Brazil. Rio de Janeiro: prope Macahé, *Riedel 635* (lectotype, designated here, LE not seen; isotype, B destroyed, photo (Rockefeller neg. #437) MO). SYNTYPE: Brazil. São Paulo: Ytú, *Riedel s.n.* (not located).

As the genera of Psychotrieae are currently circumscribed, *Mapouria* is a synonym of *Psychotria* subg. *Psychotria* (Taylor, 1996). The lectotype designated here is chosen over the other syntype because of the wide availability of a photo and its designation with a collection number.

Acknowledgments. I thank the curators of F, HRCB, IAC, SP, SPF, R, RB, and UEC for access to specimens; the coordinator of the Rubiaceae for the "Phanerogamic Flora of São Paulo State," Sigrid Luiza Jung Mendaçolli, the staff and the students at IAC, UEC, and SP, and especially Elisette Araújo da Anunciação (SP), Alice Côrrea (SP), and Rosely Buzanelli Torres (IAC), for their generous scientific collaboration and logistical help; R. E. Gereau and J. H. Kirkbride, Jr., for very helpful comments on the manuscript; and R. E. Gereau for preparation of the Latin diagnosis. This work is part of the "Phanerogamic Flora of São Paulo State" project, under the coordination of Maria das Graças Lapa Wanderley of the Instituto Botânico, São Paulo, and was very kindly supported in part by FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo).

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Morphology and Taxonomy of *Arcytophyllum serpyllaceum* (Rubiaceae), a Transfer from *Hedyotis*

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ABSTRACT. Morphological and distributional data are presented for *Hedyotis serpyllacea*, native to Guatemala and southern Mexico. The species is transferred to *Arcytophyllum*, extending the range of the genus northward from Costa Rica, Panama, and South America.

The relationships of the Mexican and Guatemalan species *Hedyotis serpyllacea* Schlechtendahl (Rubiaceae; Hedyotideae) have been problematical for some years. Its flowers, fruits, and seeds are not similar to those of *Houstonia* (Terrell, 1996), *Oldenlandia*, or *Hedyotis*. In 1893 the species was given the name *Mallostoma shannonii* Donnell Smith, and later Standley transferred it to *Arcytophyllum*. Morphological data demonstrate that Standley was correct in placing it in *Arcytophyllum;* however, a new combination is necessary.

Mena (1990), in a revision of *Arcytophyllum* Willdenow ex Schultes & Schultes f., recognized 15 species native to higher elevations in Costa Rica, Panama, and the Andes of Venezuela, Colombia, Ecuador, Peru, and Bolivia. Eleven species are erect subshrubs and four are prostrate, mat-forming, and suffruticose. Mena (1990) listed the name *Arcytophyllum shannonii* (Donnell Smith) Standley among "Excluded and Dubious Names" as a synonym for *Hedyotis serpyllacea*.

Hedyotis serpyllacea grows at high elevations (1500 to 3500 m) in Guatemala and southern Mexico (Oaxaca, Veracruz, and Chiapas) and has several vegetative and reproductive morphological similarities to species of *Arcytophyllum*. The plants are prostrate, mat-forming, and suffruticose; the stems have a "jointed" appearance; the stipules are generally similar to those of *Arcytophyllum*; the leaves are small, rather thick, and leathery; the calyx has intercalycine teeth; the corollas are rather thick, purplish externally and white within; and the capsules are broadly oblong, thick-walled, and tardily dehiscent. All of these characteristics occur especially in the prostrate, suffruticose species of *Arcytophyllum*, to which *H. serpyllacea* is most closely allied. Seeds are compressed, rounded in outline, and with a central punctiform hilum. The seeds as shown by scanning electron microscopy are very similar to those of *Arcytophyllum muticum* (Weddell) Standley, a prostrate, suffruticose species of Costa Rica, Panama, and South America.

Seeds of Hedyotideae have been found to be very important in classification (Terrell, 1996). Seeds of *Houstonia* are crateriform and the hilum is on a hilar ridge (Terrell, 1996), whereas seeds of *Hedyotis serpyllacea* are non-crateriform (without ventral depressions or cavities) and lack hilar ridges. *Oldenlandia* seeds are trigonous or conical and usually much smaller than those of the other genera. *Hedyotis* as presently recognized includes a heterogeneous array of species, as previously pointed out (Terrell, 1996). I have examined seeds of all of the Western Hemisphere species of *Hedyotis*, as well as those of many of the Asian species including the type, *H. fruticosa* L., and all of these seeds differ from those of *Hedyotis serpyllacea*.

A systematic treatment of *Arcytophyllum serpyllaceum* (*Hedyotis serpyllacea*) is presented here. This extends the distribution of *Arcytophyllum* from Panama and Costa Rica into Guatemala and southern Mexico, and also records the first collection of *H. serpyllacea* in Oaxaca (first noticed by Robert King, cited as *Terrell & King 4441*).

Arcytophyllum serpyllaceum (Schlechtendahl) Terrell, comb. nov. Basionym: *Hedyotis serpyllacea* Schlechtendahl, Linnaea 9: 599. 1834. *Houstonia serpyllacea* (Schlechtendahl) C. L. Smith ex Greenman, Proc. Amer. Acad. Arts 32: 284. 1897. TYPE: Mexico. Veracruz: between La Joya and San Salvador, June 1829, *Schiede 265* [Deppe's name was not included with Schiede's] (holotype, HAL; isotypes, F, HAL, MO; photos taken at B are at F, GH, MO, NY, US; however, the B specimen was destroyed during World War II).

Mallostoma shannonii Donnell Smith, Bot. Gaz. (Crawfordsville) 18: 203. 1893. *Arcytophyllum shannonii* (Donnell Smith) Standley, Contr. U.S. Natl. Herb. 18: 128. 1916. TYPE: Guatemala. Chimaltenango:

"forming a carpet-like turf," alt. 9000 ft., Chichoy [or Chicoy], Mar. 1892, *W. C. Shannon s.n.* (holotype, US-48603; isotype, US-943475).

Perennial herb with woody rhizomes. Stems prostrate, creeping, often matted, rooted at nodes, slender, angulate, often woody at base, glabrous or pubescent at nodes, outer layers of stem becoming loose and broken, stems often appearing jointed. Stipules to 2 mm long, ovate, with short to long, narrow caudae, these glabrous, pubescent, or ciliolate, 1–few marginal teeth with or without reddish, stalked apical glands. Leaves sessile or subsessile, 1-nerved, paler beneath, thickened, somewhat leathery, 2–9 mm long, 1–5 mm wide, ovate or elliptic, obtuse or acutish at apex, rounded at base, glabrous, margins revolute, sometimes scabrous. Flowers axillary, solitary, heterostylous, pedicels to 7 mm long, slender to stout, sometimes reflexed in fruiting stage. Hypanthium glabrous, calyx lobes 4, 1.0–3.8 mm long, 0.5–0.9(–1.5) mm wide, lanceolate, ovate, oblanceolate, or obovate, obtuse or acute at apex, sometimes with linear or awnlike intercalycine teeth to ca. 1 mm long. Corollas 6.0–10.0 mm long, funnelform, thickish, white within, typically purple or reddish purple externally on lobes, tube greenish externally; buds white or reddish purple; tube 3–5 mm long, 2–3 mm wide at throat, glabrous externally, pubescent distally within; lobes 4, 2.5–4.8 mm long, 1.2–1.7 mm wide, ovate or elliptic, thickish, densely white-pubescent within (hairs to ca. 1 mm long). Pin flowers with styles slender, whitish, stigma branches ca. 1–2.3 mm long, oblong or linear, exserted to ca. 2 mm beyond corolla throat, anthers 1–2 mm long, whitish, oblong, included in distal ½–¾ of corolla tube, on short filaments. Thrum flowers with anthers 0.9–1.8 mm long, subsessile, narrowly oblong, slightly exserted on short filaments, stigma branches ca. 1.0–1.4 mm long, whitish, broadly oblong, included in distal ½ of corolla tube, on short styles. Capsules 1.5–4.0 mm long, 2.0–3.5 mm wide, usually somewhat longer than wide, ¾ to fully inferior, broadly oblong or obovate, with several raised nerves, thick-walled, apparently tardily dehiscent or indehiscent, apex rounded and with shallow central depression. Seeds 12–29 per capsule, 0.6–1.2 mm diam., black, strongly compressed, lenticular, in outline orbicular, orbicular-polygonal, or broadly elliptic, dorsal and ventral faces convex, flat, or obscurely ridged, ventral face with hilum punctiform, ± centric, on flat or minutely depressed surface, testa finely reticulate. Flowering all year. Chromosome number not known.

Distribution. Guatemala; Mexico (Veracruz, Oaxaca, Chiapas). Grassy places, meadows, pastures, roadsides, open disturbed areas, stream banks, thin forest, alt. ca. 1500–3500 m.

Additional specimens examined. GUATEMALA. **Chimaltenango:** Chichavec, *Skutch 124* (US); Barranco de la Sierra, SE of Patzum, *Standley 61552* (MICH); near Chocoyos, *Williams 13142* (GH, MICH); Cerro Chichoy, near Chichoy, *Williams & Molina R. 15339* (GH). **Guatemala:** San José Pinula, *Salas 312* (US). **Huehuetenango:** Sierra de los Cuchumatanes, km 311 on Ruta Nac. 9 N between Paquix and Chemal, *Beaman 2983* (GH, TEX, US); Chemal, Sierra Cuchumatanes, *Molina R. & Molina 26413* (ENCB, MICH); Ruta 9N ca. 10 mi. N of Chiantla, *Sanders 74109* (MICH). **Quezaltenango:** Cuesta de El Caracol, 5–8 km N of San Juan Ostuncalco, *Williams et al. 22771* (NY, US). **Quiché:** San Miguel Uspantan, Apr. 1892, *Heyde & Lux 3176* (GH, US). **Sacatepéquez:** loc. unknown, *Standley 60766* (NY). **San Marcos:** Volcan Tacaná, E side of mountain at La Haciendita, *Beaman 3197* (GH, US). **Sololá:** hwy. CA-1, 2.5 mi. E of intersection of hwys. 1 and CA-1, *Denton 1794* (MICH). **Totonicapán:** Tecum Uman Ridge, 20 km E of Totonicapán, *Beaman 4167* (GH, TEX, US). MEXICO. **Chiapas:** San Cristóbal de las Casas, *Alexander 1063* (MICH, NY), *Breedlove 6044* (DS, ENCB, F, MICH), *Laughlin 9* (DS, LL, MSC), *Paray 323* (ENCB), near same locality, *Nee & Mori 3487* (WIS); between San Cristóbal de las Casas and Tenejapa Center, *Breedlove 9239* (DS); paraje of Yal Ichin, mpio. Chamula, *Breedlove 9532* (DS, F); Cerro Huitepec W of San Cristóbal de las Casas, *Breedlove 25299* (DS); 3 mi. NW of San Cristóbal de las Casas, *Carlson 1579* (F); loc. unknown, *Ghiesbrecht 814* (GH, K, MO, NY); San Cristóbal to Buenavista, *Miranda 4990* (MEXU); Cerro del Boquerón, *Purpus 7171* (BM, F, GH, MO, NY, US). **Oaxaca:** El Tejocote, 52 km NW of Oaxaca City, *Terrell & King 4441* (US). **Veracruz:** La Zimiento, Cofre de Perote, *Balls 4629* (US); Ingenio El Rosario, Mpio. Xico, *Narave F. et al. 293* (XAL); road to Las Minas, 3 km N of Cruz Blanca jct. with Hwy. 140, *Nee et al. 26053* (XAL), *Terrell & Koch 5381* (CHAPA, US); Las Vigas pedregal near La Joya, *Sharp 45572* (MEXU, TENN, US); Jalapa, *Smith 1486* (MO); just W of La Joya, 10 km E of Las Vigas, *Terrell & King 4455* (US), *Terrell & Koch 5380* (CHAPA, US); Zoatzingo, mpio. Altotonga, 2 km S of turn-off to Altotonga, *Terrell & Koch 5384* (CHAPA, US); San Miguel El Soldado, mpio. San Miguel, *Ventura A. 648* (US).

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Nomenclator and Review of *Phyllostegia* (Lamiaceae)

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ABSTRACT. In 1987 Harold St. John published 93 names in Hawaiian *Phyllostegia* and 1 in Tonga; only 3 of them were accounted for in the most recent taxonomic revision of the Hawaiian species by Wagner et al. in 1990. The types of these names are analyzed, and the names are here incorporated into the current classification. Only five of the new Hawaiian species are here recognized as distinct (*P. kaalaensis*, *P. kahiliensis*, *P. micrantha*, *P. pilosa*, and *P. warshaueri*), and one of the new combinations is accepted here (*P. velutina*), with the remainder here placed into the synonymy of other species. Five of the names were not validly published. The complete nomenclature of *Phyllostegia* at the species level and below is presented, including 181 names. A total of 32 Hawaiian *Phyllostegia* species are currently recognized, including the 5 recognized St. John species published in 1987 and 2 others, *P. haliakalae*, resurrected from the synonymy of *P. mollis*, and *P. renovans*, discovered in 1989. The five Hawaiian species not treated in the 1990 revision are briefly characterized and discussed. Notes adding information on taxonomy, distribution, and population and conservation status not included in the recent treatment also are given. The genus also is known from Tahiti and Tonga, each with one species; the nomenclature for these two species is included, but they are not evaluated in this paper.

In late 1987 and early 1988, as the final manuscript for the *Manual of the Flowering Plants of Hawai'i* (Wagner et al., 1990) was about to be sent to the publisher, St. John published an unfortunate, hurried series of papers, mostly cited in Wagner et al. (1990), in which he published about 880 manuscript names. Over a period of more than 30 years, he had developed lengthy manuscripts with accompanying detailed illustrations for a number of genera in a style similar to his treatment of O'ahu *Cyrtandra* (St. John, 1966), but few of them had been published. St. John published the new taxa and combinations from all of these manuscripts in *Phytologia* and in a series of privately published papers, providing little more than a brief Latin diagnosis and an abbreviated (and sometimes partly erroneous) mention of the type. This has had serious consequences: errors in citation of specimens, the use of a name more than once in the same genus (often even in the same paper), and the use of the same specimen as the type of more than one name. More importantly, he did not incorporate the taxa into a carefully evaluated taxonomic system. Now, after nearly 10 years, most of the approximately 880 names (including combinations) have been analyzed.

This is the first of a series of papers analyzing the names published in 1987 and 1988 by St. John, in which the nomenclature is evaluated and the taxa are incorporated into current classifications. The second paper will be on names in the Cucurbitaceae (Wagner & Shannon, 1999). Additional papers in this series will deal with names in *Stenogyne* (Lamiaceae), *Cyrtandra* (Gesneriaceae), and the special problems of the not valid and illegitimate names. St. John names in Campanulaceae published in 1987 and 1988 have been studied by T. Lammers (see Lammers, 1998, and papers cited therein).

Although all names for Hawaiian angiosperms published through 1986 and a few from 1987 and 1988 were included by Wagner et al. (1990) in the *Manual of the Flowering Plants of Hawai'i*, a rigorous assessment of them has never been done. The nomenclatural database, initiated in 1983 as part of the Hawaiian Flora Project at Bishop Museum, has been expanded to include all of these additional names by St. John. It will be available on the WWW in the future.

In analyzing the nomenclature for the genus *Phyllostegia* (Lamiaceae) a number of problems were discovered. These included names not validly published, errors in original publications, and typification problems. Only 3 of the 93 Hawaiian names published by St. John (1987) were incorporated into the taxonomy of the genus as treated in the most recent revision (Wagner et al., 1990). Presented here is a complete nomenclator of 181 names in *Phyllostegia*, including a number of not validly published names. Since the emphasis of this paper is on nomenclature rather than classification

or phylogeny of the group, the accepted names are arranged alphabetically. Of the 93 Hawaiian taxa (78 new species, 3 new varieties, and 12 new combinations) described by St. John, 5 of the new species are here recognized as distinct (*P. kaalaensis*, *P. kahiliensis*, *P. micrantha*, *P. pilosa*, and *P. warshaueri*), with *P. warshaueri* being adopted in the 1990 revision by Wagner et al. In addition, one of the new combinations is accepted here (*P. velutina*), which was also adopted in the Wagner et al. revision; the remainder are here placed into the synonymy of other species. Five of the names were not validly published.

The complete nomenclature of *Phyllostegia* at the species level and below is presented. A total of 32 Hawaiian *Phyllostegia* species are currently recognized, including the 5 recognized St. John species published in 1987 and 2 others, *P. haliakalae*, resurrected from the synonymy of *P. mollis*, and *P. renovans*, discovered in 1989. The five species (*P. kaalaensis*, *P. kahiliensis*, *P. micrantha*, *P. pilosa*, and *P. renovans*) not treated in the 1990 revision are briefly characterized and discussed. Notes adding information on taxonomy, distribution, and conservation status not included in the recent treatment also are given, especially for the 14 taxa listed as endangered since 1987, and others I believe to be at risk. The genus also occurs in Tahiti and Tonga, each with one species; the nomenclature for these two species is included, but they are not evaluated in this paper.

1. Phyllostegia ambigua (A. Gray) Hillebrand, Fl. Hawaiian Isl. 350. 1888. *Phyllostegia brevidens* A. Gray var.? *ambigua* A. Gray, Proc. Amer. Acad. Arts 5: 343. 1862. TYPE: Hawaiian Islands [U.S.A.]. Maui: West Maui, 1840, *U. S. Expl. Exped. s.n.* (holotype, US-57473; isotype, GH not seen).

Phyllostegia grandiflora (Gaudichaud) Bentham var. *hirsutula* Hillebrand, Fl. Hawaiian Isl. 349. 1888. *Phyllostegia brevidens* A. Gray var. *hirsutula* (Hillebrand) Sherff, Amer. J. Bot. 21: 699. 1934. TYPE: Hawaiian Islands [U.S.A.]. Maui: West Maui, in forests, s.d., *E. Bishop 76* (holotype, B presumably destroyed, photo F not seen). Maui: West Maui, mauka of McGregor, rain forest, 9 Mar. 1952, *O. Degener, Tam, Tousley & Barber 22024* (neotype, designated by Sherff (1953: 18), F not seen; isoneotypes, BISH, US). Sherff designated the Degener specimen as lectotype, but it must be taken as a neotype.

Phyllostegia brevidens A. Gray var. *expansa* Sherff, Bot. Gaz. (Crawfordsville) 96: 139. 1934. TYPE: Hawaiian Islands [U.S.A.]. Maui: West Maui, [Pu'u Kukui] Mt. Eke, 1851–1871, *W. Hillebrand s.n.* (holotype, B presumably destroyed).

Phyllostegia brevidens A. Gray var. *heterodoxa* Sherff, Amer. J. Bot. 21: 700. 1934. *Phyllostegia heterodoxa* (Sherff) H. St. John, Phytologia 63: 175. 1987. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Ka'u, Na'alehu, along Hilea Trail, 1600–3000 ft., 15 Jan. 1912, *J. F. Rock 10014* (holotype, BISH-510654; isotypes, F not seen, BISH [2]). Locality and date from Rock's field notes.

Phyllostegia brevidens A. Gray var. *pauciflora* Sherff, Bot. Gaz. (Crawfordsville) 96: 139. 1934. TYPE: Hawaiian Islands [U.S.A.]. Maui: [East Maui], South Haleakala, 1851–1871, *W. Hillebrand s.n.* (holotype, B presumably destroyed).

Phyllostegia brevidens A. Gray var. *pubescens* Sherff, Bot. Gaz. (Crawfordsville) 96: 138. 1934. TYPE: Hawaiian Islands [U.S.A.]. Maui: [East Maui], Upper Kula, s.d., *J. M. Lydgate s.n.* (holotype, B presumably destroyed).

Phyllostegia brevidens A. Gray var. *degeneri* Sherff, Amer. J. Bot. 28: 28. 1941. TYPE: Hawaiian Islands [U.S.A.]. Maui: [East Maui], Haleakala, NW side of Ko'olau Gap, in fogswept jungle, 6000 ft., 20 Aug. 1939, *O. Degener, E. Ordoñez & F. C. Salucop 12464* (holotype, F not seen [mounted on 2 sheets]; isotypes, BISH, NY [microfiche]).

Phyllostegia degeneri Sherff, Brittonia 12: 172. 1960. TYPE: Hawaiian Islands [U.S.A.]. Maui: [East Maui], Haleakala, W side of Ko'olau Gap, in rich, open forest, 28 May 1959, *O. Degener & W. Fleming 25235* (holotype, F not seen; isotypes, BISH [2], F not seen, NY [microfiche], US).

Phyllostegia longimontis H. St. John, Pacific Sci. 30: 29. 1976. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: [Kona, 26–29 Jan. 1779], *D. Nelson s.n.* (holotype, BM-550453).

Phyllostegia alba H. St. John, Phytologia 63: 172. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: [West Maui, Honokahau Drainage Basin, summit of Eeka, upper part of main ridge], 27 Sep. 1917, *C. N. Forbes 363.M* (holotype, BISH-53537; isotype, BISH).

Phyllostegia chartacea H. St. John, Phytologia 63: 173. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, Waikamoi Trail, May 1911, *J. F. Rock s.n.* (holotype, BISH-53379).

Phyllostegia elliptica H. St. John, Phytologia 63: 174. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, Hana Forest Reserve, 5675 ft., 29 June 1973, *B. Harrison 257* (holotype, BISH-513265; isotype, BISH).

Phyllostegia hiati H. St. John, Phytologia 63: 175. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, Ko'olau Gap, Ainahou, 6000 ft., 16 Feb. 1980, *R. Hobdy 762* (holotype, BISH-522877). R. Hobdy (pers. comm.) indicated that the collection number is 769, not 762 as indicated in protologue.

Phyllostegia konaensis H. St. John, Phytologia 63: 176. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Hanehane, Kona, a few miles SW of Pu'uwa'awa'a, 16 June 1911, *C. N. Forbes 183a.H* (holotype, BISH-53371). St. John used a portion of *Forbes 183.H*, and added "a" to the collection number; the other portion of this collection was published as the holotype of *P. decumbens* and *Stenogyne adpressa*. Neither of these names is validly published under ICBN Art. 34.2 (Greuter et al., 1994).

Phyllostegia lebishopii H. St. John, Phytologia 63: 177. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, Haleakala, Pu'u o Kakae, 4700 ft.,

15 Apr. 1971, *L. E. Bishop, [W.] Gagné & S. L. Montgomery 0471113* (holotype, BISH-573150).

Phyllostegia odorata H. St. John, Phytologia 63: 179. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: West Maui, Kapilau Ridge, 28 Feb. 1980, *R. Hobdy 775* (holotype, BISH-522878).

Phyllostegia orientalis H. St. John, Phytologia 63: 179. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, gulch next to base camp ridge, USFWS Forest Bird Survey, 6300 ft., 18 May 1985, *F. R. Warshauer 2535* (holotype, BISH-511688).

Phyllostegia pilosicincta H. St. John, Phytologia 63: 179. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, Haleakala, Upper Waikamoi, 14 Jan. 1976, *E. Smith & J. Davis s.n.* (holotype, BISH-522875; isotype, BISH).

Phyllostegia pluriflora H. St. John, Phytologia 63: 180. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: *I. M. Tomich 4005* (holotype, BISH not seen). The holotype has been missing since at least October 1987. Tentative disposition, based on the description.

Phyllostegia repanda H. St. John, Phytologia 63: 180. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: South Kohala Dist., Kohala Mountains, SW of Pu'u Poho'ula'ula, wet 'ohi'a forest, USFWS Forest Bird Survey Transect 80 (33/34), 4160 ft., 31 July 1979, *L. Stemmermann & S. L. Montgomery 3976* (holotype, BISH-469848).

Phyllostegia suaveolens H. St. John, Phytologia 63: 181. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Kilauea Forest Reserve, near fence line of Meyer's Ranch, 4300 ft., 15 Apr. 1980, *J. Davis 276* (holotype, BISH-520029).

The range of *Phyllostegia ambigua* is expanded on the island of Hawai'i somewhat with the addition of the types placed here to include Kilauea Volcano, the Kohala Mountains, and at least until 1911 Hualalai in addition to Mauna Loa. It also occurs on East and West Maui.

2. Phyllostegia bracteata Sherff, Bot. Gaz. (Crawfordsville) 96: 137. 1934. TYPE: Hawaiian Islands [U.S.A.]. Maui: West Maui, Pu'u Kukui, [upper] forest, 4000–5000 ft., 24–26 Sep. 1916, *A. S. Hitchcock 14746* (holotype, US-873135).

Phyllostegia bracteata historically occurred at a number of widely separated localities on East and West Maui, but is now quite rare with apparently only a few populations still extant. It has only been collected a few times this century, and was most recently collected in 1992 (Waikamoi, East Maui, *Wood et al. 1623*, NY, PTBG, US). According to J. Lau (pers. comm. 1998) there are several extant populations, including one along the Waikamoi Flume road, and another on the Waikamoi Flume, Kipahulu Valley and the adjacent Manawainui. He estimated there are most likely a number of unreported populations since there is a lot of wet forest habitat on East and West Maui, and it is in relatively good shape.

3. Phyllostegia brevidens A. Gray, Proc. Amer. Acad. Arts 5: 343. 1862. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: [in the forest] on Mouna [Mauna] Kea, 3000 ft., 1840, *U. S. Expl. Exped. s.n.* (holotype, US-57474; isotype, GH not seen).

Phyllostegia polyantha H. St. John, Phytologia 63: 180. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Kulani project land S of Mauna Loa Boys' School, moist gully, open to scattered *Metrosideros* forest with open *Cibotium* understory, 5700 ft., 26 Feb. 1981, *G. Clarke 574* (holotype, BISH-520031).

Phyllostegia brevidens was considered to be extinct, because it was known from only two collections made in the mid to late 1800s (Wagner et al., 1990). It has been recently discovered on East Maui in Kipahulu Valley, and rediscovered on Hawai'i (type of *P. polyantha*). It is apparently known from only a few populations and probably should be considered endangered. These collections, at least one of which I earlier determined as *P. ambigua*, did not completely fit the description of *P. brevidens* provided by Wagner et al. (1990). They appear to be better accommodated within a somewhat emended *P. brevidens* than in *P. ambigua*, where they did not fit the description provided by Wagner et al. (1990) in the more numerous flowers per verticillaster (14–30), glabrate in the upper part and densely hirsute on lower stems, smaller calyx 4–6 mm long, and the nearly obsolete calyx lobes (or on Maui with lobes up to 1.8 mm long).

Specimens examined. HAWAIIAN ISLANDS [U.S.A.]. **East Maui:** Kipahulu Valley, lower dog leg, 730 m, 9 Mar. 1988, *Wagner et al. 5897* (BISH, PTBG, US); Kipahulu Valley, Palikea drainage, 2920–3050 ft., 20 May 1994, *Wood et al. 3200* (AD, BISH, MO, NY, PTBG, US). **Hawai'i:** [North Hilo District], Hakalau National Refuge, Piha, 100 m in from Maulua middle fence, 5450 ft., 8 Oct. 1991, *Perlman & Jeffery 12293* (PTBG); [South Hilo District] Hilo, *Hillebrand & Lydgate s.n.* (BISH), *Hillebrand s.n.* (BISH); McCandless Ranch, Waiea Section, rain forest, . . . growing from the floor of a collapsed lava tube . . . [which] prevented cattle from reaching subject plant, 16 Apr. 1985, *Giffin s.n.* (BISH).

4. Phyllostegia electra C. N. Forbes, Occas. Pap. Bernice P. Bishop Mus. 6(3): 180. 1916. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: power line trail between Kapaka and Kualapa, 6–9 Aug. 1909, *C. N. Forbes 143.K* (holotype, BISH-499098; isotypes, BISH [2], MO not seen).

Phyllostegia mollis Bentham var. *skottsbergii* Sherff, Field

Mus. Nat. Hist., Bot. Ser. 17: 577. 1939. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Koke'e, in dense woods, 3600 ft., 8 Mar. 1926, *G. P. Wilder 451* (holotype, F-954570 [photo F not seen]).

Phyllostegia mollis Bentham var. *resinosa* Fosberg, Occas. Pap. Bernice P. Bishop Mus. 16(15): 345. 1942. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: plateau at head of Kalalau Valley, in wet forest, 375 m, 29 Dec. 1935, *F. R. Fosberg 12696* (holotype, BISH not seen). The holotype has been missing at least since August 1997.

Phyllostegia mollis Bentham var. *fagerlindii* Sherff, Occas. Pap. Bernice P. Bishop Mus. 20(1): 13. 1949. *Phyllostegia fagerlindii* (Sherff) H. St. John, Phytologia 63: 174. 1987. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: northernmost Kaua'i, Hanalei Valley, above second house, 9 Mar. 1948, *F. Fagerlind & C. Skottsberg 6533* (holotype, S [photo F not seen]). Published as in GB; however, the photograph in the original publication labeled "type" is of a specimen at S.

Phyllostegia mollis Bentham var. *hochreutineri* Sherff, Bot. Leafl. 8: 18. 1953. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Waimea, near the Gay cottage [at Kaholumanu], 1400 m, 20 Apr. 1905, *B. P. G. Hochreutiner 3579* (holotype, G [photo F not seen]). Sherff erroneously cited the island as Hawai'i.

Phyllostegia adenophora H. St. John, Phytologia 63: 172. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Kau'umohua Ridge, 27 Jan. 1920, *J. F. Rock 17313* (holotype, BISH-53740).

Phyllostegia capitata H. St. John, Phytologia 63: 173. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Alakai Swamp Trail, S of Lehuamakanoi, 3900 ft., 17 Apr. 1981, *J. H. R. Plews 80* (holotype, BISH-522872).

Phyllostegia fayi H. St. John, Phytologia 63: 174. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: near crest of ridge separating Hali'i Stream and Kamo'oloa Stream, 450 m, 28 June 1976, *J. Fay 555* (holotype, PTBG-15148; isotype, BISH). Although not indicated in the publication, the holotype belongs to PTBG; it was inadvertently mounted by BISH while on loan.

Phyllostegia electra has been collected at many localities over the past decade. It is not common anywhere, but has a wide, scattered distribution in mesic and wet forest over much of Kaua'i. It is probably the most commonly collected species of the genus on Kaua'i. It has a partly overlapping distribution with *P. helleri*, with which it is sometimes confused, but differs in its short-hispidulous pubescence, the trichomes 0.1–0.3(–0.5) mm long, and usually some of the trichomes are gland-tipped. It is probably most closely related to *P. parviflora*.

5. Phyllostegia floribunda Bentham, Labiat. Gen. Spec. 653. 1835. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: [probably 26–29 Jan. 1779], *D. Nelson s.n.* (holotype, BM-550454 [photo BISH not seen]; isotype, BM).

Phyllostegia floribunda Bentham var. *forbesii* Sherff, Amer. J. Bot. 21: 699. 1934. *Phyllostegia forbesii* (Sherff) H. St. John, Pacific Sci. 30: 25. 1976. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Kona, Ka'alapu'uwale, 30 June 1911, *C. N. Forbes 294.H* (holotype, MO-821348; isotypes, BISH [3]).

Phyllostegia villosa H. St. John, Pacific Sci. 30: 31. 1976 [1977]. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: upper edge of Waipio Valley, along trail from back of Waimea, 4000 ft., June 1910, *J. F. Rock 8352* (holotype, BISH-510103).

Phyllostegia axillaris H. St. John, Phytologia 63: 172. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Hilo Forest Reserve, Laupahoehoe section, between Ka'awali'i and Kaiwilahilahi Streams, 3420 ft., 2 Feb. 1982, *S. Anderson 488* (holotype, BISH-518753).

Phyllostegia floribunda is considered to be rare, known from a few scattered sites; it was most recently collected in 1982 and again in 1991 behind the Volcano Village dump (*Flynn 761*, PTBG, and *Wood et al. 505*, PTBG not seen), and in 1982 between Ka'awali'i and Kaiwilahilahi Streams (type of *P. axillaris*). J. Lau (pers. comm. 1998) indicated that extant populations are known from Puna District (couple of sites in Pu'u Maka'ala; Kahaualea; couple of places on the East Rift Zone; and Volcano Dump), North Hilo District (several locations in Laupahoehoe), and South Kona District (Kukuiopae).

This red-flowered species, along with *P. knudsenii* and *P. wawrana*, was placed in *Phyllostegia* sect. *Lateriflorae* A. Gray by Sherff (1935). The same delimitation was followed by Wagner et al. (1990). Based on the ample material of the white-flowered species now at hand I exclude them from the section, because they have both axillary and terminal inflorescences, which was the only character to distinguish the section.

6a. Phyllostegia glabra (Gaudichaud) Bentham var. **glabra**

Phyllostegia glabra (Gaudichaud) Bentham, Edwards's Bot. Reg. 15: 1292. 1830. [Epithet published as "*glabrum.*"] *Prasium glabrum* Gaudichaud, Voy. Uranie 452. 1829. TYPE: s.l., 550–735 m, 1819, *C. Gaudichaud-Beaupré s.n.* (holotype, P not seen).

Phyllostegia chamissonis Bentham, Linnaea 6: 79. 1831. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: 1816–1817, *L. C. A. von Chamisso s.n.* (holotype, LE not seen).

Phyllostegia macraei Bentham, Prodr. 12: 554. 1848. *Phyllostegia glabra* (Gaudichaud) Bentham var. *macraei* (Bentham) Sherff, Bot. Gaz. (Crawfordsville) 96: 136. 1934. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: 9–26 May 1825, *J. Macrae s.n.* (lectotype, designated by Sherff (1935: 31), K). Additional syntypes, O'ahu: *Beechey s.n.*, *Nelson s.n.*

Phyllostegia glabra (Gaudichaud) Bentham f. *fauriei* O. Degener & I. Degener, Fl. Hawaiiensis, fam. 316. Phyllostegia glabra. Part 2. 1960. TYPE: Hawaiian

Islands [U.S.A.]. Kaua'i: Waimea, 1000 m, 1910, *U. Faurie 896* (holotype, BISH-510030). The label may not be correct as to island because this species is otherwise unknown from Kaua'i. Although the Degeners did not indicate where the type was located, the leaf description closely fits the BISH collection. Part 2 was published on 8 Aug. 1960.

Phyllostegia rubritincta H. St. John, Phytologia 63: 181. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Lana'i: extreme head, Maunalei, on S slope of Lanaihale, 10 Mar. 1915, *G. C. Munro s.n.* (holotype, BISH-53448).

6b. Phyllostegia glabra (Gaudichaud) Bentham var. **lanaiensis** Sherff, Bot. Gaz. (Crawfordsville) 96: 136. 1934. *Phyllostegia lanaiensis* (Sherff) H. St. John, Phytologia 63: 177. 1987. TYPE: Hawaiian Islands [U.S.A.]. Lana'i: side of mountain, 1864–1865, *H. Mann & W. T. Brigham 354* (holotype, F not seen; isotype, BISH).

Phyllostegia glabra var. *lanaiensis* is listed as endangered (Herbst, 1990, 1991). It is historically known from Lana'ihale, but was definitely known only from Kaiholena Gulch (Herbst, 1991), and was last observed in the 1980s by R. Hobdy in a gulch feeding into the back of Maunalei Valley, another drainage from Lana'ihale (Herbst, 1990, 1991); however, this observation appears to have actually been of *P. glabra* var. *glabra* (J. Lau, pers. comm. 1998).

7. Phyllostegia grandiflora (Gaudichaud) Bentham, Edwards's Bot. Reg. 15: 1292. 1830. *Prasium grandiflorum* Gaudichaud, Voy. Uranie 453. 1829. TYPE: s.l., 530–735 m, 1819, *C. Gaudichaud-Beaupré s.n.* (holotype, P not seen).

Phyllostegia grandiflora (Gaudichaud) Bentham var. *majoricalycis* H. St. John, Phytologia 63: 175. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: s.l., May 1825, *J. Macrae s.n.* (holotype, GH-1421).

8. Phyllostegia haliakalae Wawra, Flora 55: 530. 1872. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, foot of Haleakala, in dry ravine, 1869–1870, *H. Wawra 1874* (holotype, W not seen; isotype, W).

Phyllostegia imminuta (Sherff) H. St. John, Phytologia 63: 175. 1987. Syn. nov. *Phyllostegia helleri* Sherff var. *imminuta* Sherff, Amer. J. Bot. 21: 699. 1934. TYPE: Hawaiian Islands [U.S.A.]. Lana'i: Kaiholena, 17 Mar. 1916, *Mrs. C. Forbes s.n.* (holotype, BISH-510031).

Phyllostegia mollis Bentham var. *micrantha* Sherff, Amer. J. Bot. 21: 700. 1934. TYPE: Hawaiian Islands [U.S.A.]. Lana'i: Maunalei Valley, 25 June 1913, *C. N. Forbes 170.L* (holotype, BISH-510099).

Phyllostegia deltoidea H. St. John, Phytologia 63: 174. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: gulch of Maunahui, 21 Mar. 1910, *J. F. Rock 6127* (holotype, BISH-53705; isotype, GH).

Phyllostegia makawaoensis H. St. John, Phytologia 63: 177. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, Makawao, *J. M. Lydgate s.n.* (holotype, BISH-53689). The type is possibly a mixed collection; a densely villous sterile stem represents either another species or a juvenile shoot. The label on this collection is one made by Forbes for Hillebrand and Lydgate material, which gives both as collectors and was used on many collections made exclusively by Lydgate.

Phyllostegia triquerta H. St. John, Phytologia 63: 182. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, Haleakala, Ulapalakua, 7000 ft., 1864–1865, *H. Mann & W. T. Brigham 404* (holotype, BISH-53687; isotype, GH).

This species was treated as *Phyllostegia imminuta* by Wagner et al. (1990), but examination of the type of *P. haliakalae* showed it to be the same taxon. It was historically known from Lana'i (last collected in 1928 near Maunalei, *Munro 247*, BISH), East Maui (Wagner et al., 1990), and from Moloka'i (*Degener 5395* in 1928, BISH); it is apparently extinct as it has not been collected in 70 years.

9. Phyllostegia helleri Sherff, Bot. Gaz. (Crawfordsville) 96: 138. 1934. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: above Waimea, Kaholuamanoa [Kaholuamanu], 12 Oct. 1895, *A. A. Heller 2875* (holotype, US-368712; isotypes, F not seen, GH not seen, MO, NY microfiche seen). The date on the holotype and the GH and NY sheets is 11–16 Oct., but both Heller and Sherff cited 12 Oct. for this collection.

Phyllostegia olokeleensis H. St. John, Phytologia 63: 179. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Olokele, *J. M. Lydgate 15* (holotype, BISH-53552).

Phyllostegia helleri was listed from only Koke'e Plateau and Mount Kahili by Wagner et al. (1990). The Mount Kahili collections have been excluded here as *P. kahiliensis*. *Phyllostegia helleri* appears to be closely related to *P. wawrana*, now that more material is available of the latter species, but differs in its shorter hirtellous pubescence, the trichomes 0.5–1 mm long, strictly terminal inflorescences, shorter pedicels (1–)3–5 mm long, and calyx veins relatively inconspicuous. It is known from the Koke'e Plateau and appears to be extinct, as it has not been collected since 1916 (*Hitchcock 15367*, US; Oct. 1916, *Rock s.n.*, BISH).

10. Phyllostegia hillebrandii H. Mann ex Hil-

lebrand, Fl. Hawaiian Isl. 350. 1888. TYPE: Hawaiian Islands [U.S.A.]. Maui: [East Maui], woods of Kula, July 1858, *W. Hillebrand s.n.* (lectotype, designated by Sherff (1936: 30), B [presumably destroyed, fragment BISH-499095]; isolectotype, BISH). Additional syntype: woods of Ulupalakua, *W. Hillebrand s.n.* (B presumably destroyed). Another sheet at BISH states "Ulapalakua and Kula, East Maui." US has one sheet collected by Hillebrand without a specific locality.

Phyllostegia hillebrandii is known only from the two collections cited above and is almost certainly extinct (Wagner et al., 1990).

11. Phyllostegia hirsuta Bentham, Edwards's Bot. Reg. 15: 1292. 1830. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: 9–26 May 1825, *J. Macrae s.n.* (holotype, K). Published as "*P.? hirsuta.*"

Phyllostegia hirsuta Bentham var. *laxior* O. Degener & Sherff, in Degener, Fl. Hawaiiensis, fam. 316. Phyllostegia hirsuta. 1934. *Phyllostegia laxior* (O. Degener & Sherff) H. St. John, Phytologia 63: 177. 1987. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: summit of Pig-god Trail, Hau'ula, 31 May 1931, *O. Degener, K. K. Parks, D. L. Topping & W. Bush 5363* (holotype, F not seen; isotype, BISH).

Phyllostegia ternaria H. St. John, Phytologia 63: 182. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Wai'anae [Mountains], Kalua'a-Lualualei Ridge, Kalua'a, on N face, well-shaded open but steep terrain, 808 m, 7 Mar. 1982, *J. Obata, P. Kores, M. Touw & K. Simens 441* (holotype, BISH-520636; isotypes, BISH [3]).

Phyllostegia hirsuta, although historically known from the central Wai'anae Mountains (from Kukui'ula (Pahole) Gulch to North Palawai Gulch) and nearly throughout the Ko'olau Mountains (from Pupukea-Kahuku Trail to Palolo Valley), is now restricted to 10 populations in the Wai'anae Mountains in the southern part of its range from Makaha and Wai'anae Kai to North Palawai Gulch, and from only 6 populations in the Ko'olau Mountains from Kawainui Gulch in Kawailoa Training Area to South Kaukonahua drainage. It was listed as endangered in 1996 (Bruegmann, 1995c; Russell & Bruegmann, 1996b). The total number of known individuals is less than 200. J. Lau (pers. comm. 1998) gave a view seemingly at variance with this assessment of less than 200 individuals. He said, "There are numerous populations in the Wai'anae Mountains, with many plants. There are also many populations in the Ko'olau Mountains, with many plants, although it has not been seen in recent decades in the southern part of the mountain range."

12. Phyllostegia hispida Hillebrand, Fl. Hawaiian Isl. 353. 1888. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: heights of Mopulehu, July 1870, *W. Hillebrand s.n.* (holotype, B [presumably destroyed, fragment BISH-510033]; isotypes, MEL not seen [photo BISH], US [possible]).

Phyllostegia hispida is known only from the mountainous eastern portion of Moloka'i. It was last collected in 1979 (*Jacobi & Higashino 1561,* BISH). The current status of all populations is not known, and J. Lau (pers. comm. 1998) considered this species to be endangered. He reported that only three solitary plants have been seen in recent years, and one of them died about two years ago. Both of the living plants are on the Pelekunu rim, one in Kamakou Preserve, the other in Pu'u Ali'i Natural Area Reserve. The dead plant was in Kamakou Preserve in the Waikolu Drainage.

13. Phyllostegia kaalaensis H. St. John, Phytologia 63: 176. 1987. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Wai'anae Mts., below Pu'u Pane, Palikea Gulch, 45° slope, mesic summer dry forest, 1900 ft., 24 Apr. 1977, *J. Obata, G. Carr & D. Palmer 77–315* (holotype, BISH-522881; isotype, BISH).

Wagner et al. (1990) discussed the populations here treated as *Phyllostegia kaalaensis* as possibly distinct from *P. glabra. Phyllostegia kaalaensis* differs from *P. glabra* in having leaves with dentate margins and calyces and bracts sparsely ciliate. It is listed as endangered (Bruegmann, 1995c; Russell & Bruegmann, 1996b). It is known from only five populations and about 50 individuals from scattered areas in the Wai'anae Mountains ('Ekahanui Gulch, Pahole Gulch, Palikea Gulch, and Wai'anae Kai). In August and September 1998 J. Lau (pers. comm. 1998) visited several populations of *P. kaalaensis* at three locations (Wai'anae Kai, Pahole Gulch, and 'Ekahanui Gulch), with a total of about 20 plants. The other populations (Palikea Gulch, and additional drainages in Pahole and Ekahanui Gulches) have not been revisited in 10–20 years. Lau estimated the total number of plants still alive may be under 100. The Wai'anae Kai population has gone way down in numbers since it was first found seven years ago. The mesic habitat of this species is very threatened.

14. Phyllostegia kahiliensis H. St. John, Phytologia 63: 176. 1987. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: steep, moist slope just below the summit of Kahili Peak, to the south,

860 m, 4 Jan. 1974, *J. J. Fay 156* (holotype, PTBG-5552; isotype, BISH).

The three collections of this species from Mount Kahili at ca. 860 m were included under *Phyllostegia helleri* by Wagner et al. (1990), but they pointed out that unlike all other populations of *P. helleri* these three specimens (the type, *Flynn et al. 2228*, PTBG, and *Wagner et al. 5217*, BISH) have retrorsely appressed pubescence and may represent a distinct taxon. *Phyllostegia helleri* always has spreading trichomes throughout its range. It seems best to recognize the population with retrorsely appressed pubescence as distinct. Similar pubescence differences are characteristic in a number of other species in the genus, often making identifications difficult. It also has pedicels only 1–2 mm long, whereas *P. helleri* has pedicels usually 3–5(–9) mm long. Field or greenhouse study is needed to determine whether there are other differences. *Phyllostegia kahiliensis* is apparently very rare.

15. Phyllostegia knudsenii Hillebrand, Fl. Hawaiian Isl. 354. 1888. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: woods of Waimea, s.d., *V. Knudsen 190* (holotype, B [presumably destroyed, fragment BISH-49904]).

Phyllostegia knudsenii was known only from the type collection from the woods of Waimea on Kaua'i and was considered extinct by Wagner et al. (1990). An individual of this species was located in the Koai'e Canyon growing in diverse mesic forest and was reported by Lorence et al. (1995). It was listed as endangered based on this rediscovery (Bruegmann, 1995a; Russell & Bruegmann, 1996a). It is currently known from two locations in Koai'e Canyon.

This species, along with *P. wawrana* and *P. floribunda*, was placed in *Phyllostegia* sect. *Lateriflorae* A. Gray by Sherff (1935). The same delimitation was followed by Wagner et al. (1990). Based on the ample material now at hand I exclude all but the type, *P. floribunda*, from the section, because the others have both axillary and terminal inflorescences. With the exclusion of these two white-flowered species the section can now also be characterized by red corollas.

16. Phyllostegia lantanoides Sherff, Bot. Gaz. (Crawfordsville) 96: 137. 1934. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Ka'ala Mts., 1864–1865, *H. Mann & W. T. Brigham s.n.* (holotype, CU [photo F not seen]).

Phyllostegia atomifera H. St. John, Phytologia 63: 172. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Mt. Ka'ala, boggy area behind chopper landing pad in tangle of *Rubus penetrans*, May 1981, *B. H. Gagné s.n.* (holotype, BISH-512414).

Phyllostegia lantanoides Sherff var. *konahuanuiana* H. St. John, Phytologia 63: 177. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Manoa-Palolo ridge, 2450 ft., 6 Jan. 1932, *H. St. John 11506* (holotype, BISH-404541; isotype, BISH).

Phyllostegia oahuensis H. St. John, Phytologia 63: 178. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Ka'ala summit, boggy spot near TV station, 4025 ft., 12 Apr. 1981, *B. H. Gagné s.n.* (holotype, BISH-440780).

17. Phyllostegia macrophylla (Gaudichaud) Bentham, Edwards's Bot. Reg. 15: 1292. 1830. [Epithet published as "*macrophyllum.*"] *Prasium macrophyllum* Gaudichaud, Voy. Uranie 453. 1829. TYPE: s.l., 550–735 m, 1819, *C. Gaudichaud-Beaupré s.n.* (holotype, P). Based on distribution of this species, Gaudichaud probably collected the type on Hawai'i. St. John treated this collection as mixed, using the short infructescence as the holotype of *P. interrupta* H. St. John.

Phyllostegia clavata Bentham, Edwards's Bot. Reg. 15: 1292. 1830. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: "Owhyee, monte ignovomo," 1825, *J. Macrae s.n.* (holotype, K not seen).

Phyllostegia macrophylla (Gaudichaud) Bentham var. *phytolaccoides* Sherff, Bot. Gaz. (Crawfordsville) 96: 137. 1934. *Phyllostegia phytolaccoides* (Sherff) H. St. John, Phytologia 63: 179. 1987. TYPE: Hawaiian Islands [U.S.A.]. Maui: [East Maui], E of Olinda, very wet forest along pipe line, 4000 ft., 1 Oct. 1916, *A. S. Hitchcock 14897* (holotype, US-1172391).

Phyllostegia macrophylla (Gaudichaud) Bentham var. *remyi* Sherff, Bot. Gaz. (Crawfordsville) 96: 136. 1934. *Phyllostegia remyi* (Sherff) H. St. John, Phytologia 63: 180. 1987. TYPE: Hawaiian Islands [U.S.A.]. Maui: s.l., 1851–1855, *J. Rémy 386* (holotype, GH-1425; isotype, P not seen).

Phyllostegia brevilobata H. St. John, Phytologia 63: 173. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: West Maui, Honokahau drainage basin, 25 Sep.–17 Oct. 1917, *C. N. Forbes 502.M* (holotype, BISH-53669).

Phyllostegia cernua H. St. John, Phytologia 63: 173. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: North Hilo Dist., Laupahoehoe section of Hilo Forest Reserve, 3100 ft., 4 Mar. 1981, *L. W. Cuddihy & J. Davis 770* (holotype, BISH-513588; isotype, BISH).

Phyllostegia hualalaiensis H. St. John, Phytologia 63: 175. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Pu'u Hualalai, Pu'uwa'awa'a, 5500 ft., 29 Dec. 1931, *H. St. John, J. W. Coulter, Hashimoto, Lindsay & Mitchell 11355* (holotype, BISH-520688; isotypes, BISH [6]).

Phyllostegia interrupta H. St. John, Phytologia 63: 176. 1987. Syn. nov. TYPE: Sandwich, *C. Gaudichaud s.n.* (holotype, P). St. John treated the type of *Prasium macrophyllum* as a mixed collection, using the

short infructescence as the holotype of *P. interrupta* H. St. John.

Phyllostegia kohalaensis H. St. John, Phytologia 63: 176. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Mountains of Kohala, W of Honokanenui Gorge, June 1910, *J. F. Rock 8377* (holotype, BISH-53655 [and -53656]; isotype, BISH). The isotype is numbered 8378. Rock often numbered his duplicates individually; the status is based on locality and date.

Phyllostegia lehuaensis H. St. John, Phytologia 63: 177. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Kona, Pulehua, Jan. 1912, *J. F. Rock s.n.* (holotype, BISH-92705; isotype, BISH).

Phyllostegia ovata H. St. John, Phytologia 63: 179. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Honaunau Forest Reserve, 'ohi'a-koa forest, 4050 ft., 28 Mar. 1980, *G. Clarke, J. Davis, L. Cuddihy & C. Corn 3* (holotype, BISH-520640; isotypes, BISH [3]).

Phyllostegia phytolaccoides (Sherff) H. St. John var. *salebrosa* H. St. John, Phytologia 63: 179. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: *F. R. Warshauer 2876* (holotype, BISH not seen). The holotype has been missing since at least October 1987; there is a specimen of *P. macrophylla*: Maui: Hana District, along Koukouai Gulch, SW of Kipahulu Valley, wet koa-'ohi'a forest, 22 July 1980, *Warshauer & McEldowney 2867* (BISH-469843), which may be the type if St. John transposed the number.

Phyllostegia plurinodosa H. St. John, Phytologia 63: 180. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Kohala Mts., USFWS Forest Bird Survey Transect 77, Stat. 5 53/54, 2500 ft., 2 Aug. 1979, *F. R. Warshauer 2495* (holotype, BISH-520653).

Phyllostegia reflexa H. St. John, Phytologia 63: 180. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Hilo Forest Reserve, Laupahoehoe Section, within 100–200 ft. of W boundary of fenceline [with] Waipunalei, 8 Sep. 1981, *J. Davis 598* (holotype, BISH [on loan from Hawaii State Division of Land and Natural Resources]). Although published as at BISH, the holotype is part of a Hawaii State Division of Land and Natural Resources loan that will hopefully be given to BISH for permanent storage following recommendation 7A of the ICBN (Greuter et al., 1994).

Phyllostegia retrorsa H. St. John, Phytologia 63: 180. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Hilea forests, 8 May 1961, *J. F. Rock s.n.* (holotype, BISH-53648).

Phyllostegia rubescens H. St. John, Phytologia 63: 181. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Hilo Forest Reserve, Laupahoehoe section, W of Kilau Stream, 2750 ft., 9 Feb. 1982, *J. Davis 685* (holotype, BISH-520030).

18. Phyllostegia mannii Sherff, Bot. Gaz. (Crawfordsville) 96: 136. 1934. Nom. nov. Replaced name: *Stenogyne parviflora* H. Mann, Proc. Amer. Acad. Arts 7: 193. 1867. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, Haleakala, [NW side], 6000–7000 ft., 1864–1865, *H. Mann & W. T. Brigham 407* (holotype, GH not seen; isotypes, BISH [2], MO not seen, US).

Phyllostegia racemosa Bentham var. *bryanii* Sherff, Amer. J. Bot. 21: 699. 1934. *Phyllostegia bryanii* (Sherff) H. St. John, Phytologia 63: 173. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: heights back of Kamolo, 1851–1871, *W. Hillebrand s.n.* (holotype, B [presumably destroyed]; isotype, MEL not seen [photo BISH]).

Phyllostegia mannii is listed as endangered (Yoshioka et al., 1991; Herbst et al., 1992). The information on distribution and populations has not changed since reported by Wagner et al. (1990). It was last collected in 1979 on Moloka'i. Reports of it from 1985 by Wagner et al. (1990) based on observations rather than collections were apparently a misidentification of *P. hispida.*

19. Phyllostegia micrantha H. St. John, Phytologia 63: 178. 1987. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Wai'anae Range, Popouwela, 27 Apr. 1910, *C. N. Forbes 1589.O* (holotype, BISH-53660).

When studying the type of this species for this paper I was unable to place it in any other known species of the genus. It has small, elliptic, hirsute leaves 6–10 cm long, 6–8 flowers per verticillaster, and the calyx is only 2.5–2.7 mm long, the smallest in the genus. I therefore provisionally accept it as a distinct species. No other collections are known to me.

20. Phyllostegia mollis Bentham, Linnaea 6: 79. 1831. *Phyllostegia parviflora* (Gaudichaud) Bentham var. *mollis* (Bentham) A. Gray, Proc. Amer. Acad. Arts 5: 344. 1862. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: 1816–1817, *L. C. A. von Chamisso s.n.* (holotype, LE not seen).

Phyllostegia honolulensis Wawra, Flora 55: 531. 1872. *Phyllostegia parviflora* (Gaudichaud) Bentham var. *honolulensis* (Wawra) Sherff, Bot. Gaz. (Crawfordsville) 96: 138. 1934. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: dry woods near Honolulu, 1869–1870, *H. Wawra 1988* (holotype, W not seen [photo BISH]).

Phyllostegia obatae H. St. John, Phytologia 63: 178. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Wai'anae Range, subgulch of Kalua'a Gulch, N of the central ridge, 1900 ft., 19 Mar. 1978, *J. Obata, D. Palmer & E. Funk 354* (holotype, BISH-520646; isotypes, BISH [5]).

Phyllostegia swezeyi H. St. John, Phytologia 63: 181. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Wai'anae Mountains, Pu'u Ka'ala, Mokuleia, Kamananui, gulch E of Pu'u Kaupakuhale, 2000 ft., 23 Oct. 1932, *O. Sweezy, F. Williams, T. G. Yuncker & E. Y. Hosaka s.n.* (holotype, BISH-40354).

Phyllostegia mollis as described by Wagner et al.

(1990) was almost exclusively based on O'ahu plants, but did include some of Sherff's descriptive information because his *P. mollis* var. *mollis* was delimited in the same way as *P. mollis* by Wagner et al. I give the following diagnosis to clearly differentiate it from *P. pilosa.*

Stems densely short-hirtellous (trichomes somewhat antrorse). Leaves flaccid, ovate to occasionally elliptic-ovate, usually 10–24 cm long, 4–7 cm wide, lower surface glandular-dotted and short-hirtellous, densely so along veins, the trichomes erect, ca. 0.3 mm long, petioles (3.5–)5–7 cm long, flowers (2–4)6 per verticillaster, in relatively open and delicate inflorescences 8–17 cm long, pubescent with spreading to erect trichomes, usually 0.1–0.2 mm long, pedicels 2–3 mm long, calyx 3–4 mm long, short-hispidulous, more densely so toward the base, sometimes also more densely pubescent toward the apex, and conspicuously glandular-dotted, the teeth linear-deltate, 0.7–1 mm long, apex acute; corolla tube slender, slightly curved, 7.5–12 mm long, short-villous and conspicuously glandular-dotted, lower lip 6.5–9 mm long.

Phyllostegia mollis sensu Wagner et al. (1990) was listed as an endangered species in 1991 (Ellshoff et al., 1990, 1991a), and thus also included populations from Maui and Moloka'i giving *P. pilosa* protected status. Historically, *P. mollis* was known from the central and southern Wai'anae Mountains from Mt. Ka'ala to Honouliuli and from the Ko'olau Mountains above Honolulu. It is now known to be extant only in Kalua'a Gulch and Pu'u Kaua in the Wai'anae Mountains, and there are probably less than 50 individuals remaining. J. Lau (pers. comm. 1998) indicated he knew of only two locations for this species, with a total of about 20 plants. One population is in Honouliuli Preserve, and the other is in Schofield Barracks Military Reservation. He also mentioned that W. Takeuchi collected quite a few specimens in the late 1980s. In the label data of some of the specimens from Honouliuli (e.g., Ekahanui Gulch), he indicated that he saw fairly large numbers of this species. These populations have not been relocated.

21a. Phyllostegia parviflora (Gaudichaud) Bentham var. **parviflora**

Phyllostegia parviflora (Gaudichaud) Bentham, Linnaea 6: 79. 1831. *Prasium parviflorum* Gaudichaud, Voy. Uranie 453. 1829. TYPE: s.l., 550–735 m, 1819, *C. Gaudichaud-Beaupré s.n.* (holotype, P not seen).

Phyllostegia parviflora (Gaudichaud) Bentham var. *canescens* Sherff, Amer. J. Bot. 21: 700. 1934. TYPE: Hawaiian Islands [U.S.A.]. Maui: West Maui, mountains, 1840, *U. S. Expl. Exped. s.n.* (holotype, US-57495).

Phyllostegia parviflora (Gaudichaud) Bentham var. *major* Sherff, Amer. J. Bot. 21: 700. 1934. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Ko'olau Mts., Punalu'u, 14–21 Nov. 1908, *J. F. Rock 565* (holotype, BISH-510100). Another sheet at BISH is labeled as Rock 963, but, based on locality and date, it is a possible isotype. Rock would often number duplicate specimens of collections made on the same day and at the same place sequentially or in some cases, such as this one, renumber the duplicates.

Phyllostegia manoana H. St. John, Phytologia 63: 177. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: valley and ridge E of main Konahuinui trail, 16 Apr. 1909, *C. N. Forbes 1306.O* (holotype, BISH-53739).

Phyllostegia parviflora is listed as an endangered species (Bruegmann, 1995d; Russell & Bruegmann, 1996c). *Phyllostegia parviflora* var. *parviflora* was known historically from the Ko'olau Mountains and a single collection from West Maui (type of *P. parviflora* var. *canescens*) in 1840. It is currently known from a single population of four plants along North Kaukonahua Stream (Bruegmann, 1995d; Russell & Bruegmann, 1996c). It is also known from a population of about 30 plants collected in 1995 from Pu'u Pauao, between Poamoho and Schofield Trail (*Perlman 14705*, PTBG, WU).

21b. Phyllostegia parviflora (Gaudichaud) Bentham var. **glabriuscula** A. Gray, Proc. Amer. Acad. Arts 5: 344. 1862. *Phyllostegia glabriuscula* (A. Gray) H. St. John, Phytologia 63: 175. 1987. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Mount Kaah [Mauna Kea], 15–20 June 1825, *J. Macrae s.n.* (lectotype, here designated, GH-1430). St. John designated the other Macrae collection (also collected on Mauna Kea, June 1825, GH-1431) as the holotype of *P. curta.* He annotated this sheet as the lectotype, but did not publish the lectotypification. St. John was correct in distinguishing the two syntypes as separate collections, as the one designated holotype of *P. curta* is in early flowering and has very few glandular trichomes, whereas the other is in late flowering and has many more glandular trichomes. They do not, however, represent separate taxa in my view.

Phyllostegia curta H. St. John, Phytologia 63: 174. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Mount Kaah [Mauna Kea], 15–20 June 1825, *J. Macrae s.n.* (holotype, GH-1431). The sheet designated the holotype of *P. curta* by St. John is also one of two syntypes (both Macrae collections from Mauna Kea, June 1825) of *P. parviflora* var. *glabriuscula.* Mounted on the same sheet is a vegetative specimen of *P. parviflora* var. *parviflora* with a U. S. Expl. Exped. label, collected on O'ahu.

Phyllostegia parviflora is listed as an endangered species (Bruegmann, 1995d; Russell & Bruegmann, 1996c). *Phyllostegia parviflora* var. *glabriuscula* was known historically from a few collections from Manua Kea and has not been collected since the late 1800s and is presumed extinct.

21c. Phyllostegia parviflora (Gaudichaud) Bentham var. **lydgatei** (Sherff) W. L. Wagner, Novon 9: 282. 1999. *Phyllostegia mollis* Bentham var. *lydgatei* Sherff, Amer. J. Bot. 21: 700. 1934. *Phyllostegia lydgatei* (Sherff) H. St. John, Phytologia 63: 177. 1987. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Wai'anae Mts., 1869, *J. M. Lydgate s.n.* (holotype, B [presumably destroyed]). O'ahu: s.l., *W. Hillebrand s.n.* (lectotype, designated by Wagner (1999), US-809370).

Phyllostegia waianaeensis H. St. John, Phytologia 63: 182. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Wai'anae Range, small gulch bottom inside of South Palawai Gulch, 2300 ft., 28 Mar. 1948, *R. L. Wilbur 609* (holotype, BISH-53699).

In the revision by Wagner et al. (1990) the Wai'anae Mountain plants were thought to perhaps represent a different variety. The situation was recently evaluated (Wagner, 1999), and the Wai'anae Mountain populations were recognized as a distinct variety, *P. parviflora* var. *lydgatei.* It is known at 730–825 m, from Napepeiauolelo Gulch and North Palawai Gulch, Wai'anae Mountains, O'ahu. This taxon appears to be restricted to north-facing slopes and is quite rare, with a current estimate of one extant population in North Palawai Gulch with about 20 known individuals. When *Phyllostegia parviflora* was listed as endangered (Bruegmann, 1995d; Russell & Bruegmann, 1996c) these populations were included, although a formal name under *P. parviflora* was not yet available.

22. Phyllostegia pilosa H. St. John, Phytologia 63: 179. 1987. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, Ukulele, Mar. 1912, *J. F. Rock s.n.* (holotype, BISH-53706; isotype, BISH).

Phyllostegia brevis H. St. John, Phytologia 63: 173. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: *H. Wawra 1915* (holotype, W not seen; isotype, W). The label states only "Kauai" for the locality, but Wawra cited this collection (Flora 55: 530. 1872) as "Kauai, Wälder des Haliakala." This locality is on East Maui.

Phyllostegia brighamii H. St. John, Phytologia 63: 173. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: West Maui, ridge above Kamalaea Bay, 1864–1865, *H. Mann & W. T. Brigham 405* (holotype, GH; isotype, BISH).

Phyllostegia kamokuensis H. St. John, Phytologia 63: 176. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Kamoku Camp, 20 Mar. 1912, *J. F. Rock 6119* (holotype, BISH-53696; isotypes, BISH, NY).

Phyllostegia kauaiensis H. St. John, Phytologia 63: 176. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: *H. Wawra 2310* (holotype, W). The label states only "Kauai" for the locality, but Wawra cited this collection (Flora 55: 530. 1872) as "Kauai, Wälder des Haliakala." This locality is on East Maui.

Phyllostegia triangularis H. St. John, Phytologia 63: 182. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: above Kamolo near Pelekuna, Apr. 1910, *J. F. Rock 7023* (holotype, BISH-53691; isotype, NY).

This species was included within *Phyllostegia mollis* by Wagner et al. (1990) following Sherff (1935), but without seeing any specimens. Later, I studied specimens from Moloka'i and Maui determining them to represent a different species than the O'ahu plants. I began using the name *Phyllostegia haliakalae* for it as this was the oldest name in the synonymy of *P. mollis* in the 1990 treatment, but omitted entirely in Sherff's revision (1935). When I examined an isotype of *Phyllostegia haliakalae* I found that it represented an older name for the species treated by Wagner et al. (1990) as *P. imminuta.* Thus, I have here selected *P. pilosa* for this species among the names available. It differs from *P. mollis,* which is restricted to O'ahu, in several characters, most notably the greater number of flowers per verticillaster, closer spacing of verticillasters, shorter pedicels, smaller flowers, smaller leaves, and shorter petioles. The following is a brief diagnosis to contrast *P. pilosa* with *P. mollis,* as well as to distinguish it from other species in the genus.

Stems moderately short-hirtellous, the trichomes spreading, usually somewhat antrorsely so. Leaves ovate to occasionally elliptic-ovate, up to 8–14 cm long, 3–4.5(–7.5) cm wide, lower surface glandular-dotted and short-hirtellous, densely so along veins, the trichomes erect to somewhat crinkly, 0.2–0.3 mm long, petioles 2.5–3.2(–4.5) cm long, flowers 6–12 per verticillaster, in relatively narrow, usually simple inflorescences 7–12 cm long, pubescent with spreading to erect trichomes usually 0.1–0.2 mm long, pedicels 0.6–1.8 mm long, calyx 3.2–3.6 mm long, short-hispidulous, more densely so toward the apex, and inconspicuously glandular-dotted, the teeth linear-deltate, 0.7–1.6 mm long, apex acute; corolla tube slender, slightly curved, 7.3–10 mm long, short-villous, the trichomes somewhat appressed, and inconspicuously glandular-dotted, lower lip 3.5–5.5 mm long.

Phyllostegia mollis sensu Wagner et al. (1990) was listed as an endangered species in 1991 (Ellshoff et al., 1990, 1991a), and thus included populations from Maui and Moloka'i, giving *P. pilosa* protected status. Ellshoff et al. (1991a) reported a population of a few individuals of *P. pilosa* discovered by R. Hobdy and J. Lau in Waiopai Gulch on East Maui; I have not been able to confirm their identification. Other than this population the species was most recently collected in 1989 at Waikamoi, TNCH [The Nature Conservancy of Hawaii] preserve, in 1989 in Honomanu Gulch on East Maui (*Perlman et al. 10773*, PTBG), and in 1912 on Moloka'i (Poholua, *Forbes 102.Mo*, BISH). J. Lau (pers. comm. 1998) reported another population more than 4 km away, in the northwestern corner of Waikamoi Preserve, near the Waikamoi Flume road. He last saw this population in 1997, when there were at least three plants still alive.

23. Phyllostegia racemosa Bentham, Edwards's Bot. Reg. 15: 1292. 1830. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: montem Kaah [Mauna Kea], 15–20 June 1825, *J. Macrae s.n.* (holotype, K).

Phyllostegia rhuakos H. St. John, Phytologia 63: 181. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Kipukas, flow of 1823, level of Keawe Wye, 28 June 1915, *C. N. Forbes 983.H* (holotype, BISH-53747).

Phyllostegia racemosa is listed as endangered (Bruegmann, 1995b, 1996). Historically, it was known to usually grow epiphytically in mesic to wet forests in the Hakalau and Saddle Road areas of Mauna Kea and the Kulani/Keauhou and Kipuka Ahiu areas of Mauna Loa. Currently only four populations are known from Hakalau, Kulani/Keauhou, and in Hawaii Volcanoes National Park with at least 45 individuals (Bruegmann, 1996).

24. Phyllostegia renovans W. L. Wagner, Novon 9: 280. 1999. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Hanalei District, headwaters of Wainiha River, NE fork, just SW of Mahinakehau Ridge, 680–825 m, 29–30 Jan. 1993, *D. H. Lorence, S. Perlman & K. Wood 7315* (holotype, US-3362751; isotypes, BISH, PTBG).

Phyllostegia renovans was discovered in 1989, after the most recent revision of the genus was in press, and was not described until 1999. It is unique in the genus in that the stems resume vegetative growth after flowering. A brief diagnosis is: erect subshrub becoming scandent and the stems up to 3–4 m long, short-hirsute throughout with leaves narrowly to broadly ovate, flowers (4–)6(–8) per verticillaster, apparently the stem resuming vegetative growth after flowering, calyx campanulate, 8–12 mm long, the lobes 4–7 mm long, margins with 1 to several coarse teeth, apex acute; corolla white, ca. 19–22 mm long. It is relatively rare with 23 small populations known only from three adjacent valleys on the northeastern part of the island of Kaua'i, Hawaiian Islands (Hanakoa, Limahuli, and Wainiha), at 680–1040 m; it grows along watercourses and at the bases of waterfalls.

25. Phyllostegia rockii Sherff, Bot. Gaz. (Crawfordsville) 96: 139. 1934. TYPE: Hawaiian Islands [U.S.A.]. Maui: [East Maui], flank of Haleakala, 1220–1525 m, s.d., *J. M. Lydgate s.n.* (holotype, B presumably destroyed). This name is based on the unnamed *Phyllostegia hispida* Hillebrand var. β Hillebrand.

Phyllostegia rockii is known from only three collections from East Maui, the most recent of which was made in 1912; it is almost certainly extinct (Wagner et al., 1990).

26. Phyllostegia stachyoides A. Gray, Proc. Amer. Acad. Arts 5: 344. 1862. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: [in the district of] Waimea, 1840, *U. S. Expl. Exped. s.n.* (holotype, US-57485).

Phyllostegia stachyoides A. Gray var. *hitchcockii* Sherff, Amer. J. Bot. 21: 700. 1934. *Phyllostegia hitchcockii* (Sherff) H. St. John, Phytologia 63: 175. 1987. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Puko'o, Mr. Conradt's place, rain forest, 8 Oct. 1916, *A. S. Hitchcock 15069* (holotype, US-874519).

Phyllostegia mollis Bentham var. *glabrescens* O. Degener & Sherff, in Degener, Fl. Hawaiiensis, fam. 316. Phyllostegia mollis. 1935. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: W of Pepe'opae [Bog], open rain forest, 12 Apr. 1928, *O. Degener 5413* (holotype, F not seen; isotypes, BISH, NY). The label on the BISH sheet indicates isotypes at MO, MICH, and B.

Phyllostegia ledyardii H. St. John, Pacific Sci. 30: 27. 1976. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: [slopes of Mauna Loa above Kealakekua], 26–29 Jan. 1779, *D. Nelson s.n.* (holotype, BM-550455).

Phyllostegia brevicalycis H. St. John, Phytologia 63: 172. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: West Maui, Wailuku Pali, 21 May 1920, *C. N. Forbes 2446.M* (holotype, BISH-53760).

Phyllostegia molokaiensis H. St. John, Phytologia 63: 178. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Nualele Valley, 18 Mar. 1952, *O. Degener & A. Tam 22202* (holotype, W not seen [photo BISH]; isotype, BISH).

Phyllostegia montana H. St. John, Phytologia 63: 178. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Transect 1, Station 4, 2930 ft., 14 July 1982, *F. R. Warshauer 2408* (holotype, BISH-437828).

Phyllostegia occidentalis H. St. John, Phytologia 63: 178. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: West Maui, Ukumehame Gulch, 4500 ft., 28

Dec. 1955, *H. St. John, R. Palmer, G. Pearsall & H. A. Woolford 25696* (holotype, BISH-522873; isotype, BISH [fragment]).

Phyllostegia olokuiensis H. St. John, Phytologia 63: 179. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Wailau, Olokui, Wailele Stream, mossy rain forest, 3700 ft., 4 Feb. 1948, *H. St. John & R. L. Wilbur 23246* (holotype, BISH-630988; isotype, BISH).

Phyllostegia pilosula H. St. John, Phytologia 63: 180. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Moloka'i Dist., S of Papa'ala Pali, W of Kuana Ridge, 4500 ft., 17 July 1979, *F. R. Warshauer & P. H. McEldowney 2438* (holotype, BISH-522982).

Phyllostegia stachyoides is now quite rare and is probably endangered, despite its three-island distribution on eastern Moloka'i, West Maui, and Hawai'i. The most recent collections are from Moloka'i (Wawaia Gulch in 1997, *Wood 6280*, AD, BISH, NY, PTBG, US) and collections from West Maui (Honokohau Falls in 1996, *Wood 5555*, PTBG, US, and in 1997, *Perlman & Wood 15768*, AD, BISH, HAST, K, NY, US; Lihau in 1992, *Welton & Haus 1571*, BISH; Hanaula in 1985, *Hobdy 2399*, BISH; Pu'u Kukui in 1996, *Perlman et al. 15368*, BISH, PTBG, US). I am unaware of any recent collections from the island of Hawai'i; however, J. Lau (pers. comm. 1998) indicated that The Nature Conservancy records show the most recent collection was in 1978 (North Kona, Keauhou 1).

27. Phyllostegia tahitensis Nadeaud, Enum. Pl. Tahiti 56. 1873. TYPE: Society Islands. Tahiti: Mount Marau, ravines, 1200 m, 26 May 1859, *J. Nadeaud 373* (holotype, P not seen; isotype, G not seen).

This species is apparently known only from the type collection and is almost certainly extinct. Sherff (1935) provided a description.

28. Phyllostegia tongaensis H. St. John, Phytologia 63: 182. 1987. TYPE: Tonga. 'Ata Island, 11 Nov. 1958, *E. Soakai 226* (K not seen).

29. Phyllostegia variabilis Bitter, Abh. Naturwiss Vereine Bremen 16: 432. 1900. TYPE: Laysan, near the shore, on W and E sides, 1896–1897, *H. H. Schauinsland s.n.* (holotype, BREM not seen; isotypes, BISH [2]).

Phyllostegia arenicola H. St. John, Phytologia 63: 172. 1987. Syn. nov. TYPE: Midway Atoll. Eastern Island, central plain, 3 m, 23 Apr. 1923, *E. L. Caum 25* (holotype, BISH-53767).

Phyllostegia variabilis is extinct; it was last observed in 1961 (Wagner et al., 1990).

30. Phyllostegia velutina (Sherff) H. St. John, Phytologia 63: 182. 1987. *Phyllostegia macrophylla* (Gaudichaud) Bentham var. *velutina* Sherff, Bot. Gaz. (Crawfordsville) 96: 137. 1934. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Mauna Kea, 1840, *U. S. Expl. Exped. s.n.* (holotype, US-57471).

Phyllostegia velutina was raised to specific level by St. John, and was accepted in the most recent revision (Wagner et al., 1990). It is listed as endangered (Bruegmann, 1995b, 1996). Historically, it occurred on the southern slopes of Hualalai and the eastern, western, and southern slopes of Mauna Loa. Currently, it is known from populations in three areas (Pu'uwa'awa'a, Honuaula Forest Reserve, and Kulani/Keauhou area) with estimates of up to 116 individuals (Bruegmann, 1995b, 1996; U.S. Fish and Wildlife Service, 1998). Another population is presumably at Waiea Tract, but its location and status are unknown (Bruegmann, 1995b, 1996). Among the remaining populations I have seen specimens only from the Kulani population.

31. Phyllostegia vestita Bentham, Edwards's Bot. Reg. 15: 1292. 1830. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Byron's Bay [Hilo], 23 June–16 July 1825, *J. Macrae s.n.* (holotype, K).

Phyllostegia dentata Bentham, Edwards's Bot. Reg. 15: 1292. 1830. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Mount Kaah [Mauna Kea], 23–16 June–July 1825, *J. Macrae s.n.* (holotype, K; isotype, GH not seen).

Phyllostegia catenulata H. St. John, Phytologia 63: 173. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Parker Ranch, Pa'auhau 2, *J. F. Rock 3439* (holotype, BISH-53658).

Phyllostegia foliosa H. St. John, Phytologia 63: 175. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Alakahi, Kawainui, ditch trail, 13 July 1909, *J. F. Rock 4314* (holotype, BISH-512417).

Phyllostegia multiflora H. St. John, Phytologia 63: 178. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: mountains above Waimea, June 1910, *J. F. Rock 8312* (holotype, BISH-53771; isotype, BISH).

Phyllostegia pubens H. St. John, Phytologia 63: 180. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: South Kohala Dist., Kohala Mts. along Kehena Ditch, USFWS Forest Bird Survey transect 78(15), wet 'ohi'a forest, 4200 ft., 31 July 1979, *F. R. Warshauer & P. H. McEldowney 2477* (holotype, BISH-520644; isotype, BISH).

Phyllostegia serrata H. St. John, Phytologia 63: 181. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: South Kohala Dist., Kohala Mountains, along Kehena Ditch, USFWS Forest Bird Survey Transect 78 (20/21), 4300 ft., 2 Aug. 1979, *F. R. Warshauer & P. H. McEldowney 2490* (holotype, BISH-469857).

Phyllostegia sexiflora H. St. John, Phytologia 63: 181. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: South Hilo Dist., E slope of Mauna Kea between Pu'u Akala and Puaka'a near Honoli'i Stream, 2580 ft., 13 Sep. 1977, *F. R. Warshauer & P. H. McEldowney 1405* (holotype, BISH-469847).

32. Phyllostegia waimeae Wawra, Flora 55: 531. 1872. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: [Waimea District,] Halemanu, 1869–1870, *H. Wawra 2115* (holotype, W not seen; isotypes W [2]).

Phyllostegia cordata H. St. John, Phytologia 63: 173. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Koke'e camp, 26 June 1926, *collector unknown s.n.* (holotype, BISH-513263). The collector was almost certainly O. Degener, as he was collecting at Halemanu on 26 and 27 June 1926 (Degener, 1969).

Phyllostegia hobdyi H. St. John, Phytologia 63: 175. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: below Waimea Canyon rim on W side, 2800 ft., 3 June 1969, *R. Hobdy 109* (holotype, BISH-32511).

Phyllostegia waimeae is listed as endangered (Ellshoff et al., 1991b; Merhroff et al., 1994). It was historically known only from the western part of the Waimea Canyon drainage, including Halemanu, Ka'aha, Kaholuamanu, and Kawai'iki, but was undoubtedly more widespread in the Koke'e area. By 1969 it was known from a single individual in Waimea Canyon (Merhroff et al., 1994). Its current status is unknown, and it is perhaps extinct.

33. Phyllostegia warshaueri H. St. John, Phytologia 63: 182. 1987. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: O'okala Trail, Hamakua, 28 May 1979, *F. R. Warshauer 4005* (leg. *M. Tamich*) (holotype, BISH-520652).

Phyllostegia ambigua (A. Gray) Hillebrand var. *longipes* Hillebrand, Fl. Hawaiian Isl. 350. 1888. *Phyllostegia brevidens* A. Gray var. *longipes* (Hillebrand) Sherff, Amer. J. Bot. 21: 699. 1934. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: s.d., *J. M. Lydgate s.n.* (holotype, B presumably destroyed; isotypes, BISH, MEL not seen [photo BISH]). This plant is presently known only from Hawai'i, and there is strong doubt that the type was collected on Maui, although the original label says "probably E. Maui."

Phyllostegia warshaueri was raised to specific level by St. John and was accepted in the most recent revision (Wagner et al., 1990). It is listed as endangered (Bruegmann, 1995b, 1996). Historically, it occurred on the northern slopes of Mauna Kea (Laupahoehoe) and from the Kohala Mountains. Currently, it is known from two populations in the Kohala Mountains, with estimates of 5 to 10 individuals (Bruegmann, 1995b, 1996), and Hamakua (O'okala Trail). Since listing, it has been rediscovered in Laupahoehoe near Kilau Stream (3 to 10 plants, *Perlman et al. 14185, 14691*, both US).

34. Phyllostegia wawrana Sherff, Bot. Gaz. (Crawfordsville) 96: 139. 1934. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: s.l., 23–29 Feb.–Mar. 1870, *H. Wawra 2060a* (holotype, W not seen; isotype, W).

Considered extinct by Wagner et al. (1990), this Kaua'i endemic species was known only from four collections from Hanalei, Koke'e Stream, and the Koke'e area and was last collected in 1926. Recent collecting efforts by the National Tropical Botanical Garden (Lorence et al., 1995) resulted in discovery of five populations of *Phyllostegia wawrana*: a Makaleha Plateau site with about 20–30 plants in two populations in a lowland wet forest; a few individuals in Wainiha Valley, below Hinalele Falls in a lowland wet forest; three plants in the upper Hanakoa drainage in a montane wet forest with riparian vegetation; a population of 5–6 individuals in the back of Honopu Valley growing along a stream bed in *Metrosideros–Dicranopteris* montane wet forest; and Nuololo, Kuia Natural Area Reserve, in a *Metrosideros–Dicranopteris* montane mesic forest with a few individuals. It was listed as endangered based on these rediscoveries (Bruegmann, 1995a; Russell & Bruegmann, 1996a). *Phyllostegia wawrana* appears to be closely related to *P. helleri* but differs in the longer, stouter trichomes of the stem and inflorescences (0.6–)0.8–1.3 mm long, longer pedicels 9–11 mm long, conspicuous veins on the calyx, and in having inflorescences axillary and sometimes also terminal. This species, along with *P. knudsenii* and *P. floribunda*, was placed in *Phyllostegia* sect. *Lateriflorae* A. Gray by Sherff (1935). The same delimitation was followed by Wagner et al. (1990). Based on the ample material now at hand I exclude all but the type, *P. floribunda*, from the section, because the others have both axillary and terminal inflorescences. With the exclusion of these two white-flowered species the section can now also be characterized by red corollas.

DOUBTFUL NAMES:

Phyllostegia decemiflorifer H. St. John, Phytologia 63: 174. 1987. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: *F. R. Warshauer 1649* (holotype, BISH not seen). The holotype has been missing at least since October 1987.

Phyllostegia glandulosa H. St. John, Phytologia 63: 175. 1987. St. John did not adequately designate a unique collection as the type, as no specific locality, no date, and no collector number were given, and Rock made numerous collections in Kona. St. John only cited

"Hawai'i, Kona, *J. F. Rock.*" No Rock collection of *Phyllostegia* from Kona could be located. = Probably *P. stachyoides* A. Gray based on the description.

Phyllostegia insignis H. St. John, Phytologia 63: 175. 1987. St. John did not adequately designate a unique collection as the type, as no locality, no date, and no collector number were given. He only cited "Maui, *A. Medeiros.*" = *P. ambigua* (A. Gray) Hillebrand based on the description.

Phyllostegia kilaueaensis H. St. John, Phytologia 63: 176. 1987. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Kilauea Forest Reserve, *F. R. Warshauer & R. L. Stemmermann s.n.* (holotype, BISH not seen). No specimen matching the given information was found. = Probably *P. velutina* (Sherff) H. St. John based on the description. St. John did not adequately designate a unique collection as the type, as no specific locality, no date, and no collector number were given.

Phyllostegia secunda H. St. John, Phytologia 63: 181. 1987. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Kaholuamano, *J. F. Rock s.n.* (holotype, BISH not seen). St. John did not adequately designate a unique collection as the type, as no specific locality, no date, and no collector number were given, and Rock made numerous collections in Kaholuamano. St. John only cited "Kaua'i, Kaholuamano, *J. F. Rock.*" No Rock collection of *Phyllostegia* from Kaholuamano, Kaua'i, could be located. The short description was not adequate to determine the species.

Excluded Names:

Phyllostegia haplostachya A. Gray, Proc. Amer. Acad. Arts 5: 345. 1862. TYPE: Hawaiian Islands [U.S.A.]. Maui: sand hills [of the low isthmus], 1840, *U. S. Expl. Exped. s.n.* (holotype, US-57480; isotype, GH [fragment] not seen). Sherff (1935) cited 2 sheets at US. = *Haplostachys haplostachya* (A. Gray) H. St. John.

Phyllostegia haplostachya A. Gray var. *leptostachya* A. Gray, Proc. Amer. Acad. Arts 5: 345. 1862. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: mts. [on barren ridges], 1840, *U. S. Expl. Exped. s.n.* (holotype, US-57479; isotypes, GH not seen, K, NY not seen). = *Haplostachys haplostachya* (A. Gray) H. St. John.

Phyllostegia leptostachys Bentham, Edwards's Bot. Reg. 15: 1292. 1830. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: s.l., 1825, *J. Macrae s.n.* (holotype, K). = *Haplostachys haplostachya* (A. Gray) H. St. John.

Phyllostegia linearifolia Drake, Ill. fl. ins. pacif. 47. t. 20. 1886. TYPE: "Ins. Sandvicensibus," 1851–1855, *J. Rémy 396* (holotype, P not seen). = *Haplostachys linearifolia* (Drake) Sherff.

Phyllostegia longiflora Caum, Occas. Pap. Bernice P. Bishop Mus. 9(5): 9. 1930. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, Kula pipeline trail, edge of gulch in deep forest, 7 Feb. 1929, *H. Lyon & E. L. Caum 150* (holotype, BISH-507697; isotypes, BISH [2]). = *Stenogyne kamehamehae* Wawra.

Phyllostegia rosmarinifolia H. Mann, Boston Soc. Nat. Hist. Mem. 1: 536. 1869. Nom. nud.

Phyllostegia truncata A. Gray, Proc. Amer. Acad. Arts 5: 345. 1862. TYPE: Hawaiian Islands [U.S.A.]. Maui: 1851–1855, *J. Rémy 395* (holotype, GH not seen; isotypes, BISH, fragment of B specimen at BISH, P?). = *Haplostachys truncata* (A. Gray) Hillebrand.

Hybrids:

Phyllostegia cowanii H. St. John, Phytologia 63: 174. 1987. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Ridge Trail to Palikea, Honouliuli Forest Reserve, Wai'anae Range, 3000 ft., 4 Feb. 1948, *R. S. Cowan 808* (holotype, BISH-76011). = *P. glabra* (Gaudichaud) Bentham var. *glabra* × *P. hirsuta* Bentham. Another collection (Wai'anae Mts., Honouliuli Preserve, below Pu'u Kaua, 2770 ft., 9 May 1996, *Wood 5216*, BISH, PTBG, US) also appears to represent a hybrid of this combination. It differs, however, in its closer resemblance to *P. hirsuta*, differing from it primarily in its narrower leaves, less pubescent leaves and stems with somewhat retrorse trichomes, longer pedicels, and larger calyx. This gives the plant a superficial appearance of *P. parviflora*, but it does not have any glandular trichomes, and the nonglandular ones are much longer than in *P. parviflora*. Both putative parents occur in the general area. *Phyllostegia glabra* was growing with *Wood 5216* (according to his label), and I found collections (*Perlman 5237*, BISH, PTBG, US) of *P. hirsuta* growing at least as close as the summit crest between Pu'u Kaua and Pu'u Kanehoa.

Phyllostegia yamaguchii Hosaka & O. Degener, Occas. Pap. Bernice P. Bishop Mus. 14(3): 27. 1938. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Ko'olau Range, La'ie, Pu'u Kainapuaa, 2500 ft., 19 Dec. 1937, *E. Y. Hosaka & M. Yamaguchi 1924* (holotype, BISH-510105; isotypes, BISH [2], US). Probable hybrid of *P. glabra* (Gaudichaud) Bentham var. *glabra* × *P. hirsuta* Bentham.

Invalidly Published Names:

Phyllostegia decumbens H. St. John, Phytologia 63: 174. 1987. *Stenogyne adpressa* H. St. John, Phytologia 63: 159. 1987. Neither of these names are validly published under ICBN Art. 34.2 (Greuter et al., 1994). St. John used part of the same specimen, *C. N. Forbes 183.H* (BISH-408112), as the type of both names. = *P. ambigua* (A. Gray) Hillebrand.

Phyllostegia kauensis H. St. John, Phytologia 63: 176. 1987. *Phyllostegia moniliformis* H. St. John, Phytologia 63: 178. 1987. Neither of these names is validly published under ICBN Art. 34.2 (Greuter et al., 1994). St. John used the same specimen, *J. D. Jacobi 722* (BISH-426000), as the type for both names. = *P. macrophylla* (Gaudichaud) Bentham.

Phyllostegia leukantha H. St. John, Phytologia 63: 177. 1987. *Phyllostegia longitubata* H. St. John, Phytologia 63: 177. 1987. Neither of these names is validly published under ICBN Art. 34.2 (Greuter et al., 1994). St. John used the same specimen, *R. Hobdy 802* (BISH-522879), as the type for both of these names. = *P. ambigua* (A. Gray) Hillebrand.

Phyllostegia parviflora (Gaudichaud) Bentham var. *gaudichaudi* A. Gray, Proc. Amer. Acad. Arts 5: 344. 1862. Not validly published, as this should have been the autonymic variety (ICBN Art. 26.2; Greuter et al., 1994). = *P. parviflora* (Gaudichaud) Bentham var. *parviflora*.

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ture, handling the loans of specimens, and word processing the output from the database. I thank Debbie Carino and Clyde Imada for providing information from BISH collections for rare and endangered species, and Joel Lau for sharing his extensive knowledge of populations of Hawaiian plants. I appreciate the quick assistance of Tim Flynn, Derral Herbst, Pat Holmgren, Chris Puttock, Emily Wood, and Ken Wood with specimens. I appreciate the help of Werner Greuter, John McNeill, and Dan Nicolson for helping me apply the ICBN to the problem of simultaneous publication of two species using the same specimen. I appreciate the assistance from the staff of the Herbarium Pacificum and the National Tropical Botanical Garden during research visits there. I thank the curators of the following herbaria for the loans of specimens: BISH, BM, CU, F, G, GH, K, NY, P, PTBG, and W.

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A New Species of Hawaiian *Phyllostegia* (Lamiaceae) from Kaua'i and Recognition of a Wai'anae Mountain, O'ahu, Endangered Variety of *Phyllostegia parviflora*

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ABSTRACT. A rare new species of the Pacific genus *Phyllostegia*, *P. renovans*, is described. It is unique in the genus in that the stems resume vegetative growth after flowering. It is relatively rare, with 23 small populations known only from three adjacent valleys on the northeastern part of the island of Kaua'i, Hawaiian Islands. A new combination is also provided for the Wai'anae Mountains, O'ahu, endangered endemic variety of *Phyllostegia parviflora* now known from only one extant population of about 20 individuals.

The intensive collecting effort by the National Tropical Botanical Garden collectors during the past decade has shown that Kaua'i was one of the least effectively collected Hawaiian Islands. Kaua'i is among the most interesting because it has the highest level of single-island endemism in the archipelago (Wagner et al., 1990; Sakai et al., 1995; Wagner & Funk, 1995). Especially in need of intensive survey effort was the northeastern quadrant of Kaua'i. A number of new species and many range extensions have been made in the past several years of work in this region of the island. One of these new species is a *Phyllostegia* with a unique growth habit, in which the vegetative stem reinitiates growth after flowering. Two additional basic inflorescence patterns occur in the genus: short, congested inflorescences on usually leafless lateral branches in the axils of or below the lowermost leaves (e.g., *P. floribunda* Bentham, *P. wawrana* Sherff); and leafy, terminal, racemose inflorescences on the central stem and upper lateral branches (most of the genus, including *P. parviflora* (Gaudichaud) Bentham). The renewal of vegetative growth can be viewed as an intermediate stage between the usual type in *Phyllostegia* and the short, congested, lateral type in two species of *Phyllostegia*. The lateral type in turn has evolved further into the axillary verticillasters in *Stenogyne*, a closely related Hawaiian genus of primarily bird-pollinated vines.

Phyllostegia renovans W. L. Wagner, sp. nov. TYPE: Hawaiian Islands (U.S.A). Kaua'i: Hanalei District, headwaters of Wainiha River, NE fork, just SW of Mahinakehau Ridge, lowland wet forest with *Metrosideros polymorpha* Gaudichaud dominant, slopes moderate to steep, occasional in clearings, wet soil, 680–825 m, 29–30 Jan. 1993, *D. H. Lorence, S. Perlman & K. Wood 7315* (holotype, US-3362751; isotypes, BISH, PTBG). Figure 1.

Caulibus brevihirsutis, post anthesin recrescentibus; floribus (4)6 in quoque verticillastro; calyce 8–12 mm longi, marginibus loborum uni-paucidentatis, corolla alba, 19–22 mm longa.

Erect subshrub when young, becoming scandent and the stems up to 3–4 m long, short-hirsute. Leaves narrowly ovate to ovate, sometimes broadly so, 12.5–20 cm long, 5.0–8.8 cm wide, spreading hirsute on both surfaces, the hairs primarily concentrated on the veins on the lower surface, the veins usually red-tinged, margins coarsely dentate or serrate-dentate, apex acuminate, base truncate, broadly rounded or broadly cuneate, petioles reddish green, 3.2–5 cm long, moderately to densely hirsute, sometimes somewhat retrorsely so. Flowers (4)6 per verticillaster, sometimes the terminal one with 8 flowers, in an open, unbranched, racemose inflorescence 18–34 cm long, apparently the stem resuming vegetative growth after flowering, pedicels 9–10 mm long, sometimes on a common peduncle up to 4 mm long, moderately to densely short-hirsute, bracts ovate, the lower ones 6–11 cm long, the upper ones 2.5–3 cm long; calyx campanulate, 8–12 mm long, green, short-hirsute on both surfaces, the hairs spreading to somewhat antrorsely appressed, the lobes 4–7 mm long, widely spreading, the margins with 1–several coarse teeth, apex acute; corolla white, ca. 19–22 mm long, short-hirsute mostly on the upper side, upper lip 6–7 mm long, the lower lip 9–12 mm long. Nutlets ca. 8–9 mm long, greenish black.

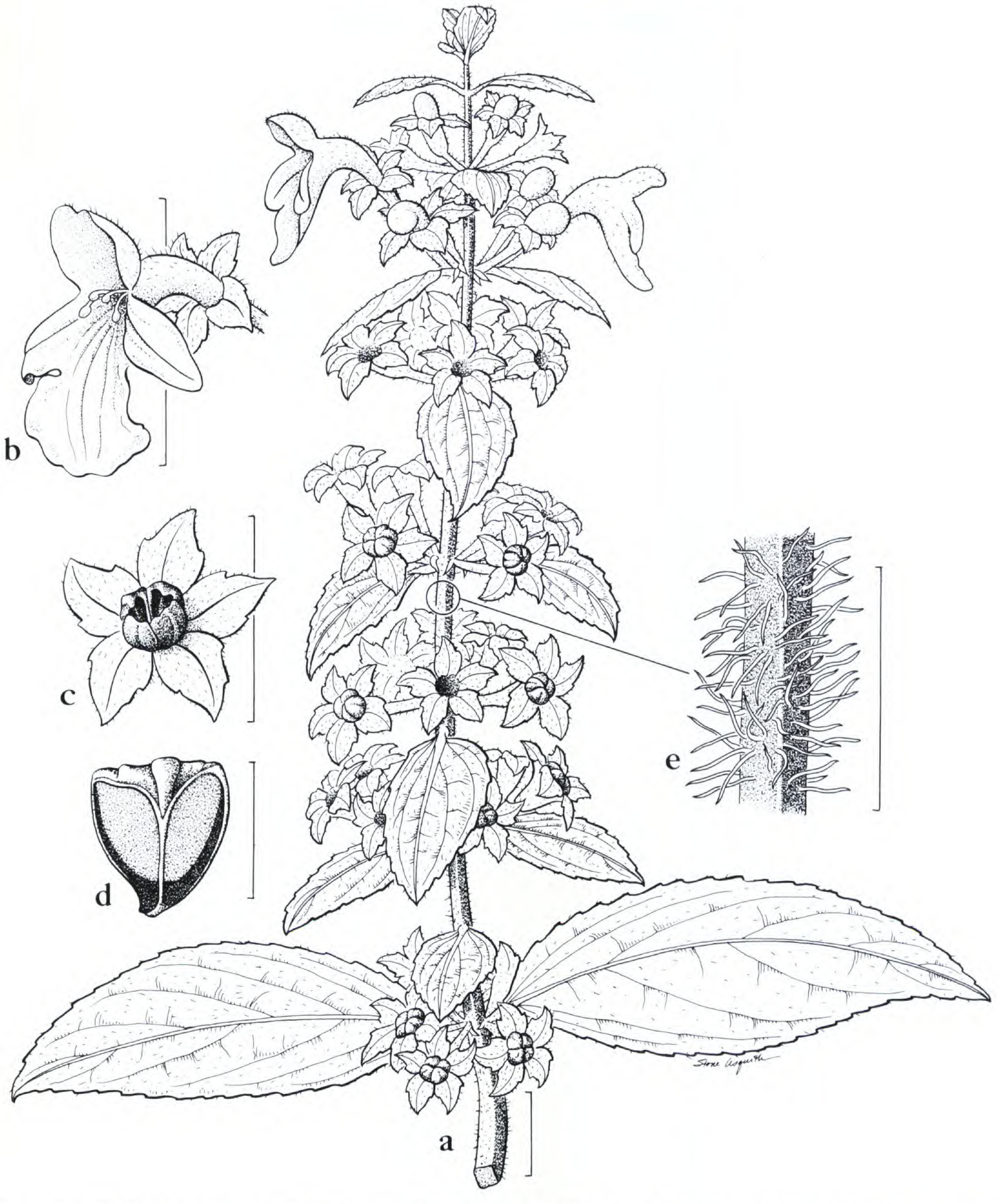

Figure 1. *Phyllostegia renovans* W. L. Wagner (*Lorence et al. 7315*). —a. Inflorescence showing the apex resuming vegetative growth. —b. Flower. —c. Calyx with maturing fleshy nutlets. —d. Nutlet. —e. Pubescence of the inflorescence. Scale bar: a–c = 2 cm; d = 1 cm; e = 2 mm. The original illustration is on indefinite loan to the Hunt Institute for Botanical documentation and featured in their 8th International Exhibition.

Distribution. Known only from the upper parts of three valleys on the northeastern side of Kaua'i, Hanakoa, Limahuli, and Wainiha, at 680–1040 m, where it grows along the watercourses and at the bases of waterfalls. A collection with only young flower buds from Wai'oli Valley (*Perlman et al. 13256*, BISH, US) may also represent this species, but is somewhat more pubescent; it should be recollected in flower or fruit for verification of its status. *Phyllostegia renovans* occurs in scattered patches; Wood (pers. comm., 1997) noted about 20 small populations in the area explored in upper Li-

mahuli Valley. The habitat is *Metrosideros polymorpha* Gaudichaud var. *glaberrima* (H. Léveillé) H. St. John wet forest near streams associated with *Antidesma platyplyllum* H. Mann, *Boehmaria grandis* (Hooker & Arnott) A. Heller, *Broussaisia arguta* Gaudichaud, *Cheirodendron*, *Cibotium*, *Cyanea*, *Cyrtandra*, *Dicranopteris linearis* (N. L. Burmann) Underwood, *Diplazium sandwichianum* (C. Presl) Diels, *Dubautia knudsenii* Hillebrand, *Freycinetia arborea* Gaudichaud, *Gunnera kauaiensis* Rock, *Hedyotis terminalis* (Hooker & Arnott) W. L. Wagner & Herbst, *Ilex anamola* Hooker & Arnott, *Labordia*, *Machaerina angustifolia* (Gaudichaud) T. Koyama, *Peperomia*, *Perottetia sandwicensis* A. Gray, *Pipturus*, *Psychotria*, *Sadleria*, *Sceavola*, *Syzygium sandwicense* (A. Gray) Niedenzu, and *Tetraplasandra*. Threats to these populations are introduced animals and plants such as *Clidemia hirta* (L.) D. Don, *Hedychium gardenarianum* Ker Gawler, and *Rubus argutus* Link.

The red coloration in the leaves occurs at least when plants are in sunny sites and apparently is less intense in shaded sites. Lorence (pers. comm., 1995) noted that the flowers are not fragrant in the morning (10–11 a.m.), but have a light fragrance at 5 p.m., suggesting moth pollination.

Paratypes. HAWAIIAN ISLANDS (U.S.A.). **Kaua'i:** Hanalei District, upper Hanakoa Valley, Honoonapali Natural Area Reserve, 3500 ft., *Perlman & Hill 10830* (BISH, PTBG, US); below and S of Pihea Peak, steep slopes with hanging valleys, along drainage, 1060 m, *Wood 1341* (AD, BISH, F, K, MO, PTBG [2]); upper Hanakoa Valley, below Pihea, on stream banks and slopes, 3400 ft., *Perlman 13998* (BISH, MO, NY, P, PTBG, US); Hanakoa drainage, 1100–1170 m, *Wood et al. 1750* (PTBG); Wainiha Valley, below Hinalele Falls, 2500 ft., *Wood et al. 2255* (PTBG, US), 2180 ft., *Perlman et al. 13215* (BISH, PTBG, US); NE fork of Wainiha River, SW of Mahinakehau Ridge, 2340 ft., *Perlman et al. 13302* (BISH, PTBG, US); upper Limahuli Valley above falls, Hono'onapali, 2600–3200 ft., *Wood et al. 3265* (PTBG), 2560 ft., *Perlman et al. 14256* (BISH, NY, PTBG, US); Limahuli Valley, back of valley below Pali Ele'ele, along stream, 2800 ft., *Perlman & Wood 15617* (BISH, PTBG, US).

When the most recent revision of *Phyllostegia* was nearing completion (Wagner et al., 1990), Steve Perlman collected *P. parviflora* in the Wai'anae Mountains, O'ahu, between Palikea and Pohakea Pass (*Perlman 5679*, BISH, PTBG). It differed from populations of this species in the Ko'olau Mountains, O'ahu, where it was historically most common, and from Maui and Hawai'i populations in its shorter pedicels 2–5(–6) mm long, spreading hairs on the petioles, slightly smaller flowers, and relatively few gland-tipped hairs in the inflorescence. Wagner et al. (1990) thought that it represented a new variety, but also that it may have already been named as *Phyllostegia mollis* var. *lydgatei* Sherff. At that time this name could not be definitely placed under *P. parviflora* since the type material is not extant. However, based on the description by Sherff (1935) and examination of the Hillebrand specimen at US annotated by Sherff, it appeared to represent the Wai'anae Mountains variety of *P. parviflora*. I have studied the US sheet cited and determined that it apparently represents the only original material of Sherff's taxon extant and that it is the same taxon as *Perlman 5679* and other subsequent collections from the Wai'anae Mountains. I therefore here make the new combination in *P. parviflora*, lectotypifiy Sherff's name, and provide a full description.

Phyllostegia parviflora (Gaudichaud) Bentham var. **lydgatei** (Sherff) W. L. Wagner, comb. nov. Basionym: *Phyllostegia mollis* Bentham var. *lydgatei* Sherff, Amer. J. Bot. 21: 700. 1934. *Phyllostegia lydgatei* (Sherff) H. St. John, Phytologia 63: 177. 1987. TYPE: Hawaiian Islands (U.S.A.). O'ahu: Wai'anae Mts., 1869, *J. M. Lydgate s.n.* (B destroyed, photo F). Sherff cited two other collections from the Wai'anae Mountains of O'ahu in addition to the type: Makaleha: *J. M. Lydgate s.n.* (B destroyed); and O'ahu: *s.l., s.d., W. Hillebrand s.n.* (lectotype, here designated, US-809370). The lectotype was annotated by Sherff.

Phyllostegia waianaeensis H. St. John, Phytologia 63: 182. 1987. Syn. nov. TYPE: Hawaiian Islands (U.S.A.). O'ahu: Wai'anae Range, small gulch bottom inside of South Palawai Gulch, 2300 ft., 28 Mar. 1948, *R. L. Wilbur 609* (holotype, BISH-53699).

Shrubby perennial herbs; stems densely antrorsely strigose, becoming hirtellous and glandular hirtellous toward and throughout the inflorescence (hairs straight or slightly curved, 0.1–0.6 mm long). Leaves rugose, ovate to broadly ovate, (15–)19–33 cm long, (6–)7.5–15.3 cm wide, both surfaces conspicuously (at least when dry) and usually densely glandular-dotted, adaxial surface appressed long-hirsute, abaxial surface hirsute to antrorsely strigose, densely so along veins, margins crenate, apex acuminate, base truncate to rounded or subcordate, petioles (5–)6–13.5 cm long, densely hirtellous. Flowers (4)6(10) per verticillaster, in leafless, usually compound, racemose inflorescences usually 10–20 cm long, consisting of the terminal primary stem and numerous secondary and tertiary lateral branches immediately below, hirtellous and sparsely to moderately glandular hirtellous throughout, pedicels 2–5(–6) mm long, bracts narrowly ovate to elliptic-ovate, 6–9 mm long; calyx campanulate, 3–

6 mm long, nerves conspicuous, hirtellous and sparsely to moderately glandular hirtellous, and glandular-dotted, the teeth narrowly deltate to linear-deltate or linear-elliptic, 1.5–2 mm long, apex attenuate to acute; corolla 10–13 mm long, white, purple-tinged at least on the upper lip, the tube curved, ca. 8–10 mm long, glandular-dotted, short-hirtellous, and glandular hirtellous, especially on the upper side, the upper lip ca. 2–3 mm long, the lower lip ca. 5–7 mm long. Nutlets ca. 3–6 mm long.

Distribution. Occurring in diverse mesic forest with *Acacia koa* A. Gray, *Antidesma*, *Claoxylon sandwicense* Müller Argoviensis, *Cyanea membranaceae* Rock, *Melicope*, *Metrosideros polymorpha* Gaudichaud, *Pittosporum*, *Pipturus albidus* (Hooker & Arnott) A. Gray, *Pouteria sandwicensis* (A. Gray) Baehni & O. Degener, *Pteralyxia macrocarpa* (Hillebrand) K. Schumann, *Solanum sandwicense* Hooker & Arnott, *Strebulus pendulinus* (Endlicher) F. Mueller, *Urera glabra* (Hooker & Arnott) Weddell, and *U. kaalae* Wawra, 730–825 m, from Napepeiauolelo Gulch and North Palawai Gulch, Wai'anae Mountains, O'ahu. This taxon appears to be restricted to north-facing slopes and is quite rare, with a current estimate of one extant population in North Palawai Gulch with about 20 individuals. *Phyllostegia parviflora* is U.S. federally listed as endangered (Russell & Bruegmann, 1996). The final rule included the Wai'anae Mountains populations here treated as *P. parviflora* var. *lydgatei* as well as those restricted to *P. parviflora* var. *parviflora* from the Ko'olau Mountains (O'ahu), West Maui, and Hawai'i. *Phyllostegia parviflora* var. *parviflora* from the Ko'olau Mountains, O'ahu, and formerly Maui is apparently now restricted to one locality and four individuals, while *P. parviflora* var. *glabriuscula* A. Gray from the island of Hawai'i has not been collected since the late 1800s and is also apparently extinct.

Specimens examined. HAWAIIAN ISLANDS (U.S.A.). **O'ahu:** Wai'anae Mountains, Napepeiauolelo Gulch, N-facing slope, 2400 ft., *Perlman 5679* (BISH, PTBG[2], US), 14 Mar. 1990, *Obata s.n.* (BISH), *Perlman & Obata 10831 pro parte* (BISH) [additional sheets under the same label at PTBG, US are *P. hirsuta* Bentham, but Perlman (pers. comm., 1997) indicated the material was not mixed when collected and no *P. hirsuta* occurs at this locality]; Honouliuli, North Palawai Gulch, N-facing slope, two subgulches down the valley, 2400 ft., *Perlman & Obata 6162* (BISH, PTBG, US), 10 Feb. 1991, *Obata & Lau s.n.* (PTBG); Honouliuli, North Palawai Gulch, N-facing slope, one subgulch down the valley, 2700 ft., *Perlman & Obata 6165* (BISH, PTBG, US).

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An Autogamous Rainforest Species of *Schiedea* (Caryophyllaceae) from East Maui, Hawaiian Islands

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ABSTRACT. A new autogamous species of *Schiedea* is described and illustrated. It is known only from cliff habitat in rainforest on a single ridge in the Natural Area Reserve, Hanawi, East Maui. With the addition of this species there are 28 species in this endemic Hawaiian genus. The new species appears to be most closely related to *Schiedea nuttallii*, a species of mesic habitats on O'ahu, Moloka'i, and Maui.

In June 1992 James Jacobi and Arthur Medeiros were collecting in the wet forests of Hanawi, East Maui, when they discovered a species of *Schiedea* Chamisso & Schlechtendal they considered to be probably new to science. It appeared similar to *S. nuttallii* Hooker, but close study of the herbarium specimens showed that it was a closely related new species from a much wetter habitat than *S. nuttallii*. In June 1995 Ken Wood and Steve Perlman revisited the population with Medeiros, W. Evanson, and R. Hobdy. They obtained seeds for greenhouse propagation at the University of California, Irvine. Studies of plants grown in the greenhouse confirmed that they represented a new species, here named *Schiedea jacobii*. With the addition of this species there are 28 species in this endemic Hawaiian genus. Observations in the greenhouse also showed that the new species is autogamous and that it shares several characteristics with another rainforest species in the genus, *S. diffusa* A. Gray. These shared characters, related to the breeding system and to seed dispersal, include anthers shedding pollen while the styles are elongated and receptive, and seeds persistent on the placenta after capsule dehiscence. The latter feature may be associated with germination of seeds in the capsule, followed by dispersal of small seedlings, as noted for *S. diffusa* (Wagner, unpublished obs.).

Schiedea jacobii W. L. Wagner, Weller & Medeiros, sp. nov. TYPE: Cultivated from seeds at University of California, Irvine greenhouse in 1997. Source: Hawaiian Islands. Maui: East Maui, Hanawi, Kuhiwa unit, E of Hanawi Stream, between Hanawai Stream and Kuhiwa drainage [20°45′N, 156°7′40″W], 6340 ft., E-facing slope, ca. 20 ft. below ridge top, in *Metrosideros* montane wet forest, 22 June 1995, *S. Perlman, K. Wood, A. Medeiros, R. Hobdy & B. Evanson 14807* (holotype, US-3351775; isotypes, BISH, CANB, CHR, K, MO, NY, PTBG). Figure 1A–H.

Haec species *S. nuttallii* similis, sed ab ea caulibus quadrangularibus, floribus autogamis, sepalis sub angulo ca. 100–135 e pedicello abeuntibus, tubo apicali 1.4–1.8

→

Figure 1. *Schiedea jacobii* W. L. Wagner, Weller & Medeiros. —A. Flowering stem. —B. Stem cross section. —C. Portion of inflorescence branch. —D. Flower, showing stamens ready to dehisce and styles elongated and receptive. —E. Adaxial view of sepal with nectary and stamen. —F. Dehisced capsule surrounded by the sepals exposing the mass of persistent seeds. —G. Seed, lateral view. —H. Seed, marginal view. Drawn from live greenhouse material of the type.

3mm
D
1cm
C
3mm
E
0.5mm
G
H
3mm
F
B
5mm
1cm
A
A.R. Tangerini
1998

mm longo nectarii omnis, stylibus plerumque 4, seminibus cohaerentibus et persistentibus differt.

Perennial herbs or subshrubs, pale yellowish green throughout; stems 4.0–7.6 dm long, ascending to sprawling when longer, conspicuously quadrangular, the angles weakly winged, glabrous throughout. Leaves opposite; blade coriaceous, 4.5–10.5 cm long, 1.4–2.6 cm wide, lanceolate to oblong-elliptic, only the midvein evident and slightly eccentric, margin slightly thickened and weakly revolute, apex acute to attenuate, base acute to obtuse; petiole 0.4–0.8 cm long, the base often flared at juncture with stem and the leaf pair slightly connate by petioles. Flowers perfect, facultatively autogamous, in diachasia on the main and upper lateral branches, these forming an open, panicle-like inflorescence 40–50 cm long, the lateral branches 11–18 cm long, ascending, each with 25–35 flowers; bracts yellowish green, foliaceous, nearly as large as the leaves in lower portions of central axis and the lateral branches, those in upper part of inflorescence and subtending flowers narrowly lanceolate to subulate, 3–11 mm long; pedicels 3–8 mm long at anthesis, elongating slightly in fruit, but none over 9 mm long, conspicuously asymmetrically flattened. Sepals 3.9–4.2 mm long, lanceolate, dull yellowish green, greener toward the midrib, sometimes with purple toward apex, thick and opaque, ascending, concave to shallowly navicular toward apex, oriented at ca. 100° to 135° angle to the pedicel, abaxially smooth and rounded, glabrous, the margins weakly scarious, sparsely ciliate, the apex attenuate. Nectary base 0.4–0.5 mm long, somewhat broadened and flattened at base, dark yellow, the nectary shaft 1.4–1.8 mm long, the apex deeply bifid. Stamens 10, the filaments weakly dimorphic, the antisepalous whorl 3.2–3.5 mm long, the alternate set 2.8–3.0 mm long, the anthers attached near the middle, subequal, 0.3–0.4 mm long, yellow, dehiscing after flower opens. Styles (3)4–5, the stigmas receptive when flower opens. Capsule ovoid, 3.7–4.2 mm long. Seeds ca. 16–22 per capsule, 0.7–0.8 mm long, suborbicular, asymmetrical, compressed, brown, rugose, remaining coherent as a unit and persistent on placenta after dehiscence, seeds eventually dispersing (or perhaps germinating *in situ* in the wild).

Etymology. We are pleased to name this species in honor of its discoverer, James D. Jacobi, Biological Resources Division, Pacific Islands Science Center, who has made significant contributions to vegetation ecology and alien plant management in Hawaii.

Distribution and ecology. Known only from wet cliffs, between Hanawai Stream and Kuhiwa drainage, East Maui, at 1930 m. This area is within a protected Hawaii State Natural Area Reserve. The habitat is a *Metrosideros* Banks ex Gaertner montane wet forest with *Cheirodendron trigynum* (Gaudichaud) A. Heller, *Coprosma ochracea* W. R. B. Oliver, *Dubautia dolosa* O. Degener & Sherff, *D. plantaginea* Gaudichaud, *Melicope* sp., *Sadleria cyatheoides* Kaulfuss, *Broussaisia arguta* Gaudichaud, *Elaphoglossum* sp., *Uncinia uncinata* (L.f.) Kükenthal, *Deschampsia nubigena* Hillebrand, *Myrsine lessertiana* A. de Candolle, *Dryopteris subbipinnata* W. H. Wagner & Hobdy, *D. wallichiana* (Sprengel) Hylander, *Labordia* sp., *Peperomia* sp., *Pipturus forbesii* Krajina, *Astelia menziesiana* Small, *Carex alligata* Boott, *Rubus hawaiiensis* A. Gray, and *Vaccinium* sp. The only known population consisted of nine plants when first discovered in 1992, although time for exploration was limited. In 1995 shoots representing only two to four plants could be located with several hours of searching the area. Two recently dead plants were located near the living ones and eight cotyledon-stage individuals, which may be this species, were found growing among bryophytes. All of the living plants in 1995 were contained within a 2-m^2 area. A separate small population located downhill in 1992 was not relocated because of a small landslide/tree fall. Other populations may occur in this rugged, largely inaccessible region of East Maui, especially on wet cliffs. Degradation of forests in the Hanawi area by alien animals appears to be the major threat to *Schiedea jacobii*. The only known population is currently without any evidence of pigs because of Natural Area Reserve System staff efforts.

Paratypes. HAWAIIAN ISLANDS. **Maui:** East Maui, Hanawi, Kuhiwa unit, E of Hanawi Stream, between Hanawai Stream and Kuhiwa drainage [20°45′N, 156°7′40″W], E-facing slope, ca. 6 m below ridge top, 22 June 1995, *Perlman et al. 14807* (US); on rock face with *Deschampsia*, 7 Apr. 1992, *Medeiros & Jacobi 798* (BISH, US).

Relationships. *Schiedea jacobii*, with its fleshy stems, large leaves with one principal vein, open inflorescence, and attenuate sepal apex, is clearly a member of the *S. nuttallii* clade as defined by Wagner et al. (1995) and Weller et al. (1995), which consists of nine hermaproditic species of mesic to wet forest. *Schiedea jacobii* appears to be most closely related to *S. nuttallii* of mesic forests on O'ahu, Moloka'i, and West Maui. This relationship is suggested by the shape and size of the leaves, similar shrubby habit, sepal size, and rugose seeds. It differs from *S. nuttallii* most conspicuously in characters related to the breeding system, espe-

cially those associated with autogamy. The most significant are the shift in timing of receptivity of the stigmas and the shorter staminal filaments. Several characters of *S. jacobii* are also found in *S. diffusa*, but appear to have been independently derived based on the evolution of autogamy in a wet forest environment. Re-analysis of the phylogeny of *Schiedea* following inclusion of *S. jacobii* in the data matrix may resolve the extent of convergence between this species and *S. diffusa* (Wagner et al., unpublished).

Breeding system. Experimental crosses in the greenhouse and observations of pollen tube growth in styles indicate that *S. jacobii* is autogamous. Emasculated flowers failed to produce capsules. In unmanipulated flowers numerous pollen tubes were observed in the styles (Weller, Sakai, Thai & Dieu, unpublished data). These results, and the production of hybrids following interspecific crosses, indicate that the abundant capsule production of this species in the absence of cross-pollination is likely to result from self-fertilization rather than apomixis. Autogamy is facilitated by the synchrony of pollen dispersal and stigma receptivity, a feature not found in most other species of *Schiedea*, which are strongly protandrous (Sakai et al., 1997). *Schiedea diffusa*, which occurs in very wet forests on Moloka'i, Maui, and Hawai'i, is also autogamous. Our observations suggest that in very wet habitats, autogamy may limit exposure of pollen to rain, which may either wash pollen from flowers or cause pollen to burst. Additionally, visitation by insects capable of pollination may be rare in very wet habitats.

Seed dispersal. Among species of *Schiedea*, retention of mature seeds on the placenta within dehisced capsules is found only in *S. jacobii*. A related species, *S. diffusa*, retains seeds within closed capsules. Seedlings of *S. diffusa* have been observed germinating within disintegrating capsules still attached to the plant. This trait may provide an advantage during establishment in wet habitats. Whether precocious germination occurs in *S. jacobii* is unknown, although seeds eventually disperse from capsules under greenhouse conditions.

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Two New Combinations in Chinese Scrophulariaceae

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ABSTRACT. Two new combinations, *Sopubia matsumurae* (T. Yamazaki) C. Y. Wu and *Xizangia bartsioides* (Handel-Mazzetti) C. Y. Wu & D. D. Tao, are proposed. *Sopubia lasiocarpa* P. C. Tsoong is reduced to synonymy of *S. matsumurae*, and *Xizangia serrata* D. Y. Hong is reduced to synonymy of *Xizangia bartsioides*.

A re-examination of the generic dispositions of certain Chinese species of Scrophulariaceae reveals that the following two species need to be re-assigned to their proper genera.

Sopubia matsumurae (T. Yamazaki) C. Y. Wu, comb. nov. Basionym: *Petitmenginia matsumurae* T. Yamazaki, J. Jap. Bot. 25: 214. 1950. TYPE: China. Jiangsu [as Kiangsu]: Nanjing [as Nangking], Chungshan, 29 Aug. 1910, *S. Matsuda s.n.* (holotype, TI).

Sopubia lasiocarpa P. C. Tsoong, Fl. Reipubl. Popularis Sin. 67(2): 405. 1979. Syn. nov. TYPE: China. Hunan: Yizhang County, Changping, 340 m, *Liang Baohan 83323* (holotype, PE).

Yamazaki (1980) reduced *Sopubia lasiocarpa* and *Petitmenginia matsumurae* to synonymy of *S. stricta* (Bentham) G. Don. *Sopubia stricta* is a southern Asiatic species that reaches its northernmost limits near some islands along the Guangdong coast, and no collections of it have been seen from mainland China. On the other hand, *S. matsumurae* is distributed in Hunan, Jiangsu, and Zhejiang provinces. *Sopubia stricta* differs from *S. matsumurae* in having entire leaves, very short pedicels that are sometimes lacking, a glabrous inner surface of the calyx, lanceolate calyx lobes, and scabrous capsules a little longer than the calyx lobes and with a flat apex. In contrast, *S. matsumurae* has leaves with 1 or 2 teeth on each side, pedicels 1.5–2 mm long, a scabrous calyx with triangular-lanceolate lobes, and hairy capsules distinctly longer than the calyx and with a curved apex.

Xizangia bartsioides (Handel-Mazzetti) C. Y. Wu & D. D. Tao, comb. nov. Basionym: *Pterygiella bartsioides* Handel-Mazzetti, Sitz. Akad. Wiss. Wien 60: 186. 1923. TYPE: China. NW Yunnan: "vallis Doyon-lumba ad fluvium Salween sub jugo Pongatong, 28°9′, s. micoschistaceo," 3450 m, 4 Aug. 1916, *Handel-Mazzetti 9671* (holotype, WU).

Xizangia serrata D. Y. Hong, Acta Phytotax. Sin. 24: 141. 1986. Syn. nov. TYPE: China. Xizang (Tibet): Bomi, 3100–3400 m, 17 Aug. 1983, *B. S. Li, Z. C. Ni & S. Z. Cheng 6601* (holotype, PE).

The study of authentic material identified by Hong De-yuan as *Xizangia serrata* and the rich collections of *Pterygiella bartsioides* from Yunnan reveals that the two taxa are conspecific. I agree with Hong (1986, 1998) that *Xizangia* D. Y. Hong is a genus distinct from *Pterygiella* Oliver and *Phtheriospermum* Bunge ex Fischer & C. A. Meyer. *Xizangia* can be readily distinguished from *Pterygiella* by having serrate instead of entire leaves and by lacking bracteoles instead of having two below the calyx. *Xizangia* differs from *Phtheriospermum* by having serrate instead of pinnatisect leaves and an unequally instead of equally parted calyx.

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Notes on Malesian Fabaceae (Leguminosae-Papilionoideae) 4. *Millettia chrysamaryssa*, a New Species from Peninsular Malaysia

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ABSTRACT. A new species, *Millettia chrysamaryssa* Adema from Peninsular Malaysia, is described.

During the preparation of an account of *Millettia* Wight & Arnott for *Flora Malesiana*, a new species was found in the material identified as *Millettia sericea* (Ventenat) Wight & Arnott.

Millettia sericea, although restricted to Sumatra, Peninsular Malaysia, and Java, has always been seen as a variable species. Various forms and varieties have been described (Miquel, 1855, 1860; Prain, 1897; Dunn, 1912). However, these forms differ only slightly among each other, and the need to discriminate them has not been substantiated. A significant group of plants, differing in indumentum, flowers, fruits, and seeds, has consistently been overlooked. These plants, all from Peninsular Malaysia, are described here as a new species.

Millettia chrysamaryssa Adema, sp. nov. TYPE: Malaysia. Perak: Padang, Selim river, 12 Apr. 1978, *Maxwell 78-107* (holotype, L; isotypes, AA, SINU not seen). Figure 1.

Liana. Axes brunneo-velutini. Folia 5–15-foliolata. Folioli elliptici ad anguste obovati raro anguste ovati infra dense sericei aurei vel argentei nitentes. Stipellae desunt. Pseudo-racemi axillares. Vexillum sine callis. Stamina monadelpha vel diadelpha fenestris basalibus. Legumina applanata late ligulata extus brunneo-velutina. Semina applanata oblonga.

Lianas. Twigs terete, 3–9 mm diam., dark brown velvety. Leaves 5–15-foliolate (mostly 13). Stipules triangular, ca. 5 × 3 mm, caducous. Petioles 4–10.5 cm long, terete, brown velvety; rachis 5–23.5 cm long, terete, brown velvety; pulvinus 7–20 mm long. Stipels absent. Leaflets: terminal elliptic to narrowly obovate, 7–19 × 2–5 cm, length:width ratio 2.5–3.8, base cuneate to rounded, apex acuminate, acumen 4–20 mm long, above glabrous, below densely silvery or golden sericeous, midrib slightly sunken above, nerves flat or slightly sunken above, 7–11 per side, 5–25 mm apart; lateral mostly as the terminal, narrowly ovate to narrowly obovate, 4–19 × 1–5 cm, length:width ratio 2.5–4.2; pulvinus 5–13 mm long. Inflorescences axillary, pseudoracemes, often apically clustered, or pseudopanicles, 18–37 cm long, peduncle 3–13 cm long, brown velvety. Bracts to the brachyblasts ovate, 2.5–3 × 1.2–2 mm, adaxially velvety, abaxially glabrous. Brachyblasts 5–10-flowered. Bracts to the flowers broadly ovate, 1.7–1.9 × 1.1–1.2 mm, adaxially velvety, abaxially glabrous. Pedicels 5–9 mm long. Bracteoles at the base of the calyx, ovate, 1.2–1.9 × 0.6–1.2 mm, adaxially velvety, abaxially glabrous. Calyx 5–7 mm long, tube 4–5 mm long, adaxially velvety, abaxially glabrous, slightly obliquely bilabiate, "lower lip" three lobes somewhat longer than upper two lobes. Corolla papilionaceous, white or pink, or yellowish white and violet at the base, standard often with a light green blotch abaxially near the base. Standard: claw 2.5–4 mm long, adaxially sericeous; blade orbicular, 10–13 × 9–14 mm, emarginate, adaxially sericeous, abaxially sericeous at the very apex, basally with auricles ca. 1 mm long, callosities absent. Wings: claw 4–5 mm long; blade narrowly ovate to elliptic, 9–11 × 3.5–4.5 mm, with some hairs at the base and auricles, dorsal auricles 0.5–1 mm

Figure 1. *Millettia chrysamaryssa* Adema. —a. Flowering branch. —b. Flower. —c. Fruit. —d. Seed. a, b from *Maxwell 78-107*; c, d from *FRI 2040*.

long. Keel petals: claw 4–5 mm long, with very few hairs; blade ± boat-shaped, 9–11.5 × 4.5–6 mm, adaxially sericeous apically, with some hairs at the base, abaxially sericeous along the ventral side in apical part. Stamens mono- or diadelphous, with basal fenestrae, 13–15 mm long, free for 3–8 mm, glabrous; anthers 0.7–1.1 × 0.4–0.6 mm, glabrous. Disc indistinct. Ovary 5–9 mm long, sericeous; ovules 3–6; style 5–6 mm long, sericeous in lower part; stigma terminal, capitate. Pod flat, broadly strap-like, ca. 14 × 5 × 0.4 cm, densely dark brown velvety adaxially. Seeds upright-oblong, ca. 24 × 16 × 2 mm, shiny black; hilum ca. 2 mm long.

Table 1. Differences between *Millettia chrysamaryssa* Adema and *M. sericea* (Ventenat) Wight & Arnott.

	M. chrysamaryssa	*M. sericea*
Indumentum	velvety	short-sericeous
Stipules	5 × 3 mm	2–3.5 × 2–3 mm
Pedicels	5–9 mm long	4 mm long
Stamens	monodelphous or diadelphous	diadelphous
Free part of filaments	3–8 mm long	2–4 mm long
Anthers	0.7–1.1 × 0.4–0.6 mm	0.6–0.7 × 0.4–0.6 mm
Pods	flat, 14 × 5 × 0.4 cm	thick, 5–7.5 × 1.5–3.5 × 1–2 cm
Seeds	flat, upright-oblong, 24 × 16 × 2 mm	thick, transverse-ellipsoid 25–45 × 10–25 × 4–13 mm

Distribution. Malesia: Peninsular Malaysia.

Habitat and ecology. Secondary forest, forest edge, roadside. Soil: sand, shale. Altitude: 30–1600 m. Flowering: March to November; fruiting: March to July.

Note. Named *chrysamaryssa* (= a golden sparkle), due to the manner in which the lower surfaces of the leaflets reflect light.

Paratypes. MALAYSIA. **Kedah:** E of G. Bongsu, Bongsu F.R., 300 m, 29 Apr. 1970, *FRI 14159* (B. Everett) (A, K). **Penang:** Pulau Penang, Western Road Cemetery, Apr. 1918, *SF 3446* (Md. Haniff) (K, SING); Titi Kerawang Hill, ca. 300 m, 06 Apr. 1968, *Sidek bin Kiah 246* (A, K, L, SING). **Trengganu:** summit leading eastern ridge G. Mandi Angin, ca. 1600 m, 12 July 1968, *FRI 12094* (T. C. Whitmore) (A, K, L SING). **Pahang:** Fraser's Hill, Gap Road, 100 m, 17 Apr. 1955, *J. W. Purseglove 4127* (A, K, L, LAE); Fraser's Hill, 21 mi. near Gap on the way to Raub, 28 June 1971, *KL 3012* (L. E. Teo & P.) (K, L, SING); Fraser's Hill, upon Selangor border, 1300–1450 m, 16–30 Sep. 1922, *I. H. Burkill & R. E. Holttum 8662* (K, SING); Balok F.R., 03 Sep. 1966, *FRI 2090* (K. M. Kochumen) (K, L, SING). **Selangor:** Gading, May 1891, *D. J. A. Hervey s.n.* (K, SING); Gading F.R., 180 m, 20 July 1969, *FRI 13385* (H. S. Loh) (K, L, SING); 47th mile Gap Road, Rawang, 08 July 1966, *FRI 2040* (K. M. Kochumen) (A, K, L, SING); Sedang experimental plantation, Sep. 1925, *Lambourne s.n.* (SING); Kuala Lumpur, near Universiti Malaya campus, ca. 30 m, 23 Nov. 1978, *B. C. Stone 14002* (BO, K, L); University campus, near the entrance gate from Petaling Jaya, Jan. 1964, *Abd. Samat bin Abdulla* 252 (K); Kepong FRIM, 28 May 1963, *Md Kasim bin Rajab 1513* (K); Kepong, near F.R.O's house, 11 Oct. 1932, *FRI 29102* (A. B. Walton) (K); Melaka, 19 Mar. 1885, *Alvins 1081* (SING); Bukit Kupayang, 07 July 1885, *Alvins 1961* (SING). SINGAPORE. Singapore, 07 July 1961, *Lobb 310* (A, K).

Differences Between *Millettia sericea* and *Millettia chrysamaryssa*

At first glance, *Millettia sericea* and the new species *M. chrysamaryssa* appear strikingly different in the way the abaxial surfaces of the leaflets reflect light: mostly silvery and more or less dull in *M. sericea*, mostly golden and more shiny in *M. chrysamaryssa*. However, this character, which is rather difficult to define, shows more overlap than originally was thought. More convincing differences are found in the pods and seeds: flat in *M. chrysamaryssa*, thick in *M. sericea* (see Table 1).

In the key to the sections of *Millettia* in Dunn's (1912) monograph, *Millettia chrysamaryssa* keys out as a member of section *Macrospermae* Dunn. With this section it shares the following characters: lianas; stipels absent; inflorescences pseudoracemes; petals sericeous with standards lacking callosities; disc indistinct. However, *M. chrysamaryssa* differs from the other species of section *Macrospermae* in its flat pods and seeds and its mono- or diadelphous stamens. The brilliant sheen of the lower leaflet surfaces of *M. chrysamaryssa* is reminiscent of the Indian species *M. splendens* Wight & Arnott and *M. rubiginosa* Wight & Arnott, both belonging to section *Typicae* Dunn. Sections *Macrospermae* and *Typicae* differ chiefly in the presence or absence of stipels.

Acknowledgments. The loan of specimens from the herbaria of A, BO, K, L, LAE, and SING is gratefully acknowledged. J. F. Veldkamp kindly translated the diagnosis into Latin. J. J. Wessendorp prepared the drawing. J. F. Maxwell, the collector of the type of the new species, was so kind to indicate where the duplicates are stored.

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A New Species of *Solanum* subgenus *Leptostemonum* (Solanaceae) from Chapada da Diamantina, Bahia, Brazil

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ABSTRACT. A new species, *Solanum diamantinense*, is described and illustrated. It is endemic to Brazil and restricted to the Chapada Diamantina in the State of Bahia, northeastern Brazil. This species is closely related to the Brazilian *Solanum baturitense* Huber, from which it differs by its oblanceolate leaf blades, short calyx lobes, and dense, stalked, glandular-stellate pubescence.

RESUMO. Uma nova espécie, *Solanum diamantinense*, é descrita e ilustrada e sua distribuícão e sua afinidade são discutidas. Espécie endêmica do Brasil, restrita à Chapada da Diamantina, estado da Bahia, nordeste do Brasil. *Solanum diamantinense* possui afinidade com *S. baturitense* Huber, da qual pode se distinguir pela lâmina foliar oblanceolada, cálice com lobos curtos e a densa pubescência com tricomas estrelados e glandular-estrelados pedicelados.

Solanum L. is the largest and most complex genus of the Solanaceae family, with about 1500 species and 5000 published epithets. It is distributed mainly throughout the tropical and subtropical regions of the world and has its center of diversity and distribution in South America.

While preparing a taxonomic revision of the *Solanum erythrotrichum* group sensu Whalen (1984) of the subgenus *Leptostemonum* Dunal, a new species was identified on the basis of its distinctive morphological characteristics and is herein named *Solanum diamantinense*.

Members of the subgenus *Leptostemonum* Dunal *Erythrotrichum* group sensu Whalen (1984) form a South American distinctive, diverse, and presumably monophyletic group that comprises species possessing ferruginous to reddish glandular-stellate pubescence, branched inflorescences, attenuate and subulate anthers, somewhat accrescent calyces, and glandular-pubescent berries with a leathery epicarp at maturity.

Solanum diamantinense M. F. Agra, sp. nov. TYPE: Brazil. Bahia: Mun. Seabra, a 2 km de Seabra, na direção de Campestre, altitude 930 m, vegetação área de contato ecológico (caatinga/floresta estacional), 3 Apr. 1998 (fl, fr), *M. F. Agra & A. M. Giulietti 5176* (holotype, JPB; isotypes, JPB, JPB, HUEFS, MO, SPF, UPS). Figure 1.

Frutex ad ramos juniores folios inflorescentiamque trichomatibus stellatis glandulosis ferrugineis tomentosus, ad caulem foliosque aculeis rufescentibus basi dilatatis compressis apice leniter recurvis armatus. Folia alterna petiolata lanceolata apiculata basi acuta marginibus integerrima utrinque tomentosa. Inflorescentia ex cyma terminali bi- vel trichotoma multiflora constans. Flos calyce breviusculo campanulato-scutellari, laciniis brevissimis tomentoso-ferrugineis; corolla alba in lacinias lanceolatas intus glabras extus stellato-tomentosas profunde partita, lobulis sub anthesi reflexis; antheris aequalibus 0.5–0.6 cm longis lanceolatis rectis; ovario depresso-globoso piloso; stylo erecto. Bacca globosa glanduloso-pilosa diametro 1.5–2.0 cm; seminibus 4–5 mm longis, lenticularibus, subreniformibus, alutaceis.

Small erect, branched, perennial shrubs 0.4–2 m tall. *Stems* terete, reddish or ferruginous tomentose with glandular-stellate trichomes and strongly armed with reddish, laterally compressed prickles that are enlarged at the base, 0.2–0.3 cm wide, 0.2–0.5 cm long, and slightly recurved at the apex, longer and more numerous on the young plants; bark of older stems glabrescent and dark brown. *Leaves* alternate, usually unarmed in adult plants; if armed, with prickles only on the midrib, lateral veins, and petioles; blades entire, bicolored, subcoriaceous, oblanceolate or elliptic, 4–12 cm long, 2–3 cm wide, acute at apex, acute and slightly attenuate at base, velutinous above with glandular and eglandular, multiseriate-stalked, ferruginous to reddish stellate hairs, 2–4 branches of the glandular-stellate hairs reflexed, unarmed or sparsely armed below with small, ferruginous to brown prickles, ferruginous to yellowish tomentose with glandular-stellate hairs, the multiseriate stalk 2–3 times longer than in hairs of upper surface; primary veins prominent, ferru-

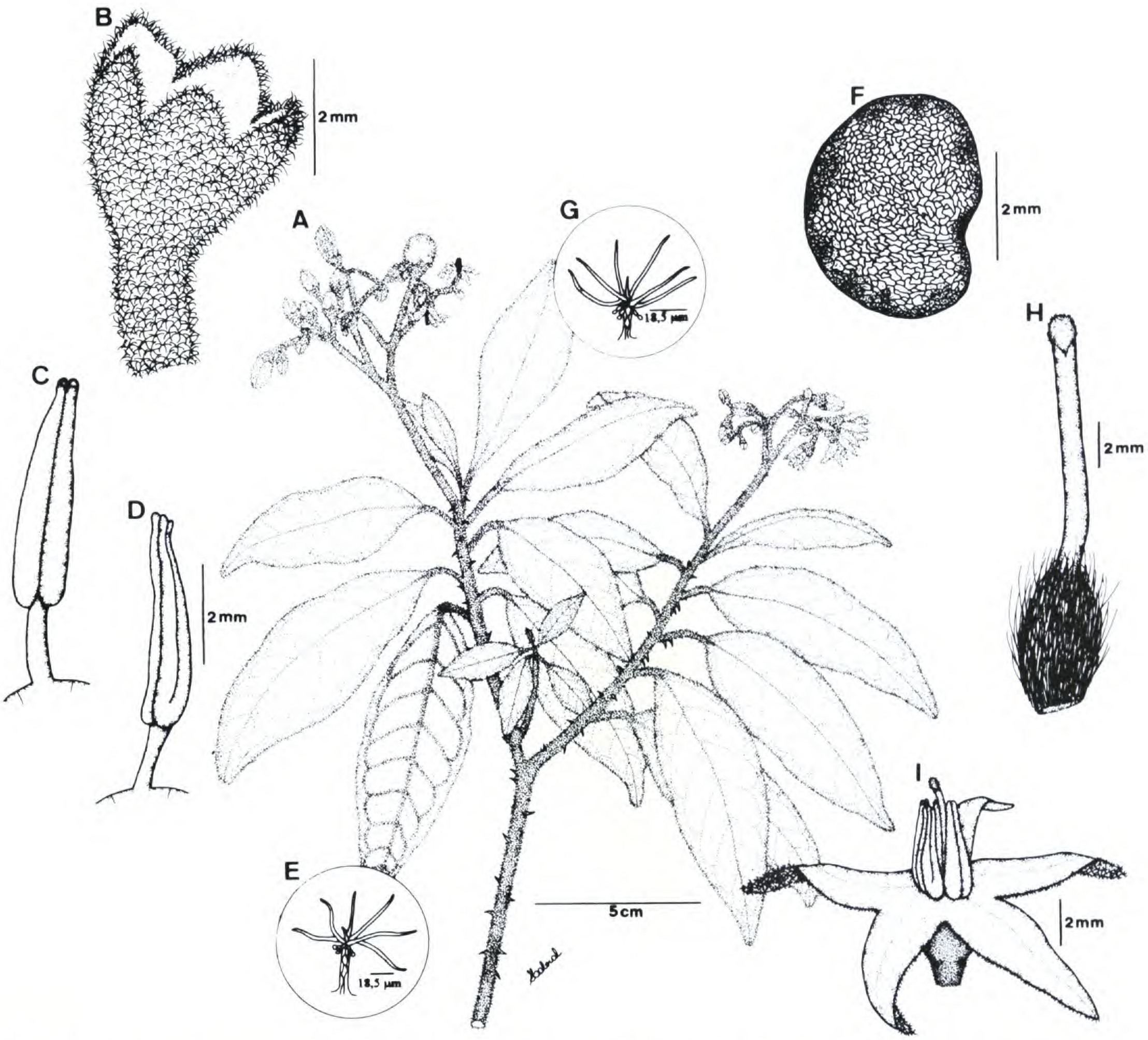

Figure 1. *Solanum diamantinense* M. F. Agra. —A. Flowering branch. —B. Calyx. —C. Stamen, front view. —D. Stamen, lateral view. —E. Stellate glandular hair from abaxial leaf surface. —F. Seed. —G. Stellate glandular hair from adaxial leaf surface. —H. Gynoecium. —I. Flower.

ginous; petioles short, 1–2 cm long, unarmed or sparsely armed with small reddish to brown prickles, densely tomentose with reddish, stalked, stellate hairs similar to those of the lower surface. *Inflorescences* terminal, 4–10 cm long, remote from the leaves, scorpioid, bi- to tri-furcate, more than 20-flowered; peduncle subterete, unarmed, unbranched, 2–10 cm long, 2–5 mm thick, ferruginous to reddish tomentose, the hairs similar to the branches and petiole; pedicels slender and articulate at the base, 3–5 mm long, with hairs similar to those of the peduncle. *Flowers* heterostylous, the basal ones with elongate and functional styles exceeding the anthers, the distal ones with reduced gynoecia. *Calyx* unarmed, subcampanulate, slightly zygomorphic, 5-lobed about ¼ the length, the lobes ca. 1 mm long, acute to apiculate, the tube ca. 2–3 mm long, 4 mm wide in flower, 8–10 mm long and 5–7 mm wide in fruit, glabrous within, ferruginous-tomentose without, with glandular stellate hairs similar to those of the petiole. *Corolla* white, long exserted from the calyx at anthesis, stelliform, 2–2.5 cm across, deeply parted, the tube 2–4 mm long, the lobes linear-lanceolate, reflexed at anthesis, 8–10 mm long, 2–4 mm wide, glabrous within, the midrib prominent, tomentose without, with ferruginous glandular-stellate hairs similar to those of abaxial surface of the leaf blades. *Anthers* equal, connivent, 5–6 mm long, linear-lanceolate, attenuate, subulate and introrse at the apex, slightly asymmetric at the base; filaments glabrous, the free part 1–2 mm long. *Ovary* depressed globose, ca. 2 mm long, densely villose with stellate hairs, the long branches of the stellae

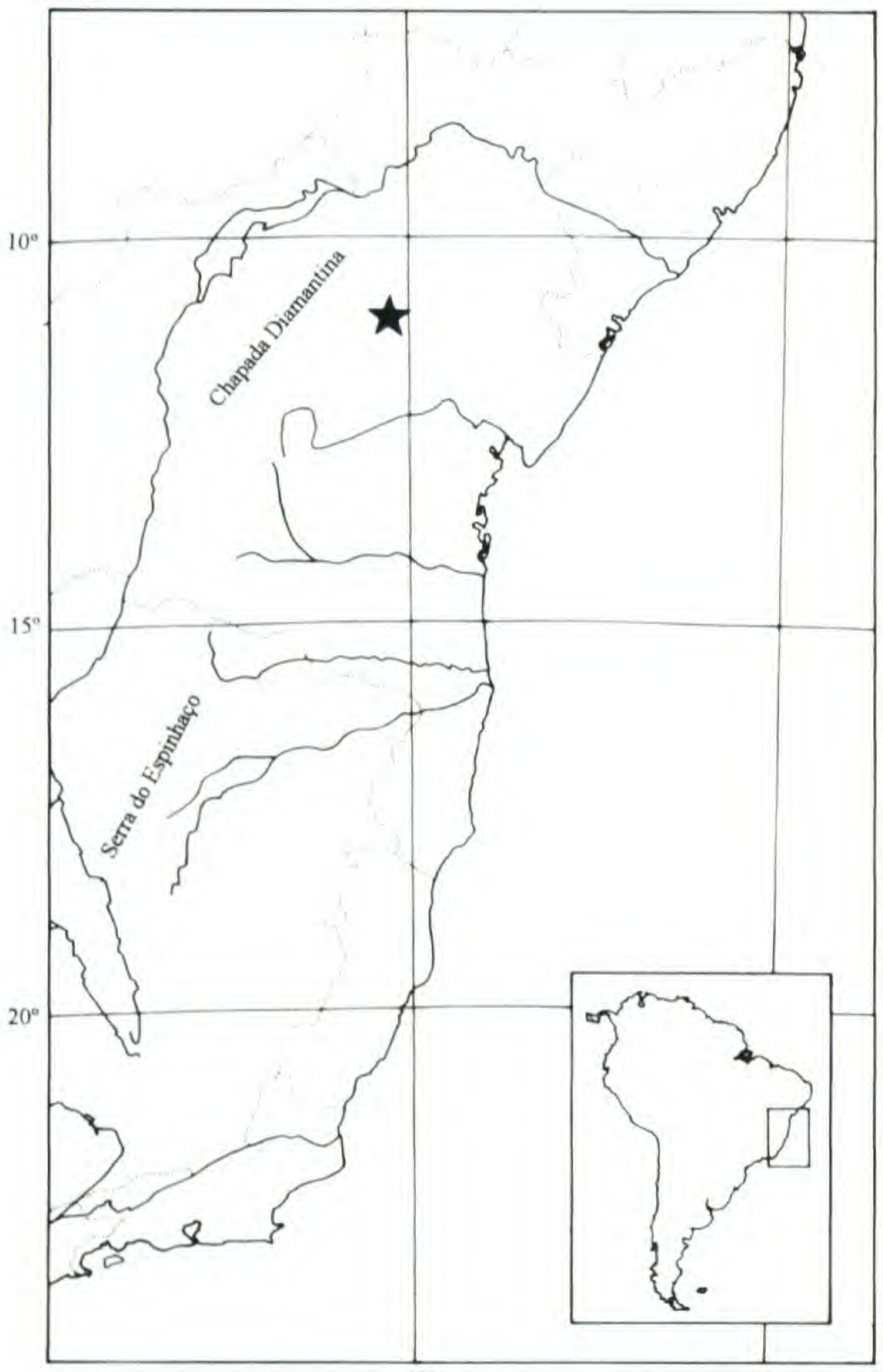

Figure 2. Distribution of *Solanum diamantinense* M. F. Agra.

2–3 mm long. *Style* glabrous, straight or curved at the apex, pubescent at base, exceeding the stamens, 8–10 mm long in functional flowers, 4–5 mm long in staminate flowers. *Stigma* clavate-truncate, dark green, shiny, minutely papillose at the tip. *Fruits* globose, held upright, 1.5–2.0 cm diam., with leathery epicarp, persistently ferruginous pubescent with glandular-stellate hairs mixed with short and long unbranched gland-tipped hairs, the calyx persistent and somewhat accrescent. *Seeds* lenticular, subreniform, brown, 4–5 mm long, 3–3.5 mm wide, the testa with fine reticulated ornamentation.

Distribution and habitat. *Solanum diamantinense* is endemic to Brazil and known only from collections from the Morro do Chapéu and Seabra, State of Bahia. It grows in secondary vegetation associated with "campos gerais" at elevations of 900–1200 m. These areas are located in the mountain zone known as the Chapada Diamantina (Fig. 2), which is one of the richest centers of diversity of plant life in Brazil and contains some of the rarest species. It is characterized by a complex mosaic of different types of vegetation (Harley, 1992). The "campos gerais" is a feature of large tracts of upland Bahia around Morro do Chapéu. It occurs on deeper soils over flat or slightly undulating ground and contains many typical cerrado species, the vegetation being dominated by grasses and low shrubs (Harley, 1995).

Affinities. *Solanum diamantinense* is similar and probably closely related to *S. baturitense* Huber, another Brazilian species. It can be distinguished from *S. baturitense* by its oblanceolate to elliptic leaves, very short calyx lobes, and dense, stalked, glandular-stellate pubescence on all parts of the plant, especially both sides of the leaves. Both species share branched inflorescences, lanceolate-subulate anthers, reddish to ferruginous pubescence, white flowers, and slightly accrescent calyces. This set of morphological characteristics makes *S. diamantinense* a very distinctive species in the informal *Erythrotrichum* group of subgenus *Leptostemonum.*

Paratypes. BRAZIL. **Bahia:** Mun. Seabra, a 12 km de Seabra, na direção de Campestre, altitude 930 m, vegetação área de contato ecológico (caatinga/floresta estacional), 15 Nov. 1983 (fl, fr), *J. A. C. Lima et al. 246* (HRB); Mun. Morro do Chapéu, lat. 11°38′34″S, 40°55′45″W, vegetação mistura (savana/estepe), latossolo, 26 Aug. 1980 (fl, fr), *H. P. Bautista 353* (HRB); Mun. Morro do Chapéu, lat. 11°31′S, long. 40°18′W, vegetação mistura (Savana/Estepe), 5 Apr. 1984 (fl, fr), *O. A. Salgado & H. P. Bautista 354* (HRB); Mun. Morro do Chapéu, elev. ca. 1030 m, 3 km S de Morro do Chapéu, caminho de Utinga, aprox. 11°35′S, 41°11′W, carrasco ou caatinga de altitude, 28 Nov. 1992 (fl, fr), *M. M. Arbo et al. 5358* (CTES not seen, GH, JPB (2), MO, RB, SP, SPF); Mun. Morro do Chapéu, ca. 4 km SW of the town of Morro do Chapéu on the road to Utinga, scrubby "campos gerais" vegetation, alt. 1150 m 11°35′S, 41°11′W, 2 June 1980 (fl), *R. M. Harley et al. 22991* (CEPEC, F, RB); Mun. Seabra, 13 Ago. 1956 (fl, fr), *E. Pereira 2162* (RB (3)); Mun. de Lagoinha, 18 km of Lagoinha, 5.5 km SW of Delfino on side road to Minas do Mimoso, disturbed woodland, secondary vegetation by cultivation, and marsh by small stream, alt. 950 m, aprox. 10°20′S, 41°20W, 7 Mar. 1974 (fl), *R. M. Harley et al. 16943* (CEPEC, IPA, K, M, MO, RB, US); Mun. Utinga, beira da estrada BA 142, próximo a Utinga 12°28′00″S, 41°27′00″W, alt. 1000 m, 10 Mar. 1996 (fl), *R. Lima et al. 2215* (HUEFS); Mun. do Morro do Chapéu, Cachoeira do Ferro Doido, 20 Km SE da cidade, alt. ca. 900 m s.m., 19 Nov. 1986 (fl), *L. P. Queiroz et al. 1305* (HUEFS); Mun. do Morro do Chapéu, 1–2 km sul da cidade na estrada para Utinga, 11°33′00″S, 41°09′00″W, 16 Nov. 1984 (fl), *L. R. Noblick 3497* (HUEFS, NY).

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Generic Placement of Species Excluded from *Arabidopsis* (Brassicaceae)

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ABSTRACT. All 59 binomials previously assigned to *Arabidopsis* are critically evaluated and placed in 14 genera, of which *Crucihimalaya*, *Olimarabidopsis*, and *Pseudoarabidopsis* are described as new. Nine new combinations in *Crucihimalaya*, three in *Olimarabidopsis*, and one in *Pseudoarabidopsis*, as well as 12 new synonyms, are proposed. A key to all genera most commonly confused with *Arabidopsis*, including the three new proposed herein, is presented.

Generic delimitation in the Brassicaceae (Cruciferae) is one of the most difficult and often controversial aspects in the systematics of the family (Al-Shehbaz, 1973, 1984; Rollins, 1993; Schulz, 1936). Perhaps the two principal reasons for this are: (1) Convergence in basically every morphological character is so high that superficially very similar genera might well turn out to be remotely related or unrelated upon critical examination of so-called key generic characters and independent assessment of phylogenetic relationship using molecular comparisons (as in the genera herein segregated from *Arabidopsis*). (2) Although the family exhibits tremendous diversity in fruit morphology, other parts of the plant, especially the flowers, usually do not show much diversity and, therefore, there are few morphological characters that can be used to determine relationships. Characters of flowers and vegetative parts have often been ignored or overlooked. Because fruit morphology has traditionally been used in taxonomic treatments of the Brassicaceae, the problem becomes more acute among the numerous genera with relatively similar linear-shaped fruits. In cases like these, vegetative or floral characters could easily be of greater significance than fruit or seed characters in delimiting natural genera.

Given the great interest in *Arabidopsis thaliana* (L.) Heynhold as a model experimental organism, it is of particular value to define clear phylogenetic groupings among its related genera. The limits of *Arabidopsis* (DC.) Heynhold have been the subject of continuous controversy, and many authors (e.g., Al-Shehbaz, 1988; Hedge (in Hedge & Rechinger), 1968; Price et al., 1994) called for the need to establish well-defined boundaries between the genus and its relatives. Although O'Kane and Al-Shehbaz (1997) retained only nine species in *Arabidopsis*, the generic placement of 50 of the 59 binomials previously assigned to *Arabidopsis* remained to be established. The present paper addresses this problem, and keys for the determination of taxa most often confused with *Arabidopsis* are provided.

Molecular comparisons of both chloroplast DNA (Price et al., 1994, unpublished) and nuclear Internal Transcribed Spacer (ITS) regions (O'Kane et al., 1995, 1997, unpublished) have consistently supported dividing the core group of the broadly circumscribed *Arabidopsis* (e.g., table 1 of Price et al., 1994) into a small number of well-separated clades, most notably *Arabidopsis* sensu stricto (including *Hylandra* A. Löve and *Cardaminopsis* (C. A. Meyer) Hayek; see O'Kane & Al-Shehbaz, 1997; Mummenhoff & Hurka, 1995), *A. pumila* (Stephan) N. Busch and relatives (here newly described as *Olimarabidopsis*), and *A. himalaica* (Edgeworth) O. E. Schulz and relatives (here newly described as *Crucihimalaya*). All of these genera belong to a major terminal clade, including a number of other Eurasian and American genera such as *Capsella* Medikus, *Neslia* Desvaux, *Erysimum* L., *Malcolmia* R. Brown, and *Halimolobos* Tausch. Several other species sometimes placed in *Arabidopsis* have been found to belong to the distantly related genera *Thel-*

lungiella O. E. Schulz (Al-Shehbaz & O'Kane, 1995; Galloway et al., 1998) and *Neotorularia* Hedge & J. Léonard (Al-Shehbaz & O'Kane, 1997), or in one case to the genus *Erysimum* (Al-Shehbaz, 1994), which is closely related to *Olimarabidopsis*. Although the taxonomy of *Arabidopsis* has now been worked out at the generic level (O'Kane & Al-Shehbaz, 1997), our research indicates that *Arabis* is polyphyletic and consists of at least three unrelated clades.

Following up the suggestions of new phylogenetic groupings provided by molecular comparisons, we have thoroughly reexamined the morphology of the species previously placed in *Arabidopsis* in order to reassess morphological groupings of species and to try to find morphological characters distinguishing the groups indicated by molecular comparisons. Over the last seven years, we have critically examined more than 6000 specimens from numerous herbaria. We have found that differences in fruit morphology (terete vs. flattened) and seed morphology (incumbent vs. accumbent cotyledons and winged vs. unwinged seeds), which have been previously used (e.g., Busch, 1909; Ball, 1993; Jones, 1964; Mulligan, 1995; Rollins, 1993; Schulz, 1936) to separate the traditionally circumscribed genera *Arabidopsis* and *Arabis*, appear to be very unreliable in the delimitation of natural generic groups. Seven of the nine species of *Arabidopsis* sensu stricto have flattened fruits and accumbent cotyledons, while two have terete fruits and incumbent cotyledons (O'Kane & Al-Shehbaz, 1997). In contrast, differences in trichome branching, flower color, and nature of the cauline leaf base appear to be much more useful in defining natural generic groups among species previously placed in *Arabidopsis* sensu lato. Combinations of these characters, along with molecular phylogenetic data, support the retention of 9 species in *Arabidopsis* and the segregation of 13 species commonly placed in the genus into three new, well-defined genera herein proposed as *Crucihimalaya*, *Olimarabidopsis*, and *Pseudoarabidopsis*. Based on chloroplast DNA sequencing (Price, unpublished), *Olimarabidopsis* is most closely related to *Erysimum*, and both are readily separated from *Arabidopsis* by having yellow or orange (rarely cream or purplish) flowers and malpighiaceous and/or sessile stellate trichomes (*Erysimum*) or submalpighiaceous and subsessile stellate trichomes (*Olimarabidopsis*).

Only 3 of the 14 genera to which the 59 *Arabidopsis* binomials belong are not included in the following key. These, *Murbeckiella* Rothmaler, *Sisymbriopsis* Botschantsev & Tzvelev, and *Robeschia* Hochstetter, are unrelated to *Arabidopsis*. *Murbeckiella* has auriculate cauline leaves, keeled valves, veined septa, and winged seeds, whereas *Arabidopsis* has petiolate cauline leaves, rounded or flat valves, veinless septa, and wingless seeds. *Sisymbriopsis* has pubescent, quadrangular fruits and prominently 3-veined valves, whereas *Arabidopsis* has glabrous, terete or flattened fruits and veinless or obscurely 1-veined valves. Finally, *Robeschia* has dendritic trichomes, 2-pinnatisect or 2-pinnate leaves, much thickened fruiting pedicels as thick as the fruit, and an obsolete style, whereas *Arabidopsis* has simple and stalked forked trichomes, undivided to pinnatifid leaves, slender fruiting pedicels narrower than the fruit, and distinct styles. These three genera have not yet been subjected to molecular studies, but should be analyzed in the near future.

The circumscriptions of *Arabis* and *Halimolobos* in the following key follow that of Rollins (1993). We are, however, aware that these genera, as presently delimited, represent very heterogeneous assemblages of species groups that will have to be re-assigned to other genera, most of which have already been proposed. We are currently working on these groups.

ARTIFICIAL KEY TO THE GENERA WITH MEMBERS FORMERLY PLACED IN *ARABIDOPSIS* SENSU LATO

1a. Plants completely glabrous; leaves and stems glaucous; plants often restricted to strongly saline and/or calcareous soil . . . . . *Thellungiella*
1b. Plants sparsely to densely hairy; leaves and stems not glaucous; plants usually on other soil types.
  2a. Trichomes sessile and completely appressed, malpighiaceous and/or stellate with unbranched rigid straight rays . . . . . *Erysimum*
  2b. Trichomes short- or long-stalked, simple or branched, if stellate and sessile then rays slender and/or branched.
    3a. Scapose annuals without cauline leaves; fruiting pedicel nearly as thick as fruit . . . . . *Drabopsis*
    3b. Nonscapose annuals, biennials, or perennials with few to many cauline leaves; very rarely perennials without cauline leaves; fruiting pedicels much narrower than fruit (except some *Neotorularia*).
      4a. Fruits compressed; cotyledons accumbent.
        5a. Cauline leaves short petiolate, neither auriculate nor sagittate at base; trichomes simple and 2- or 3(or 4)-forked, never dendritic or stellate; fruit valves with a prominent midvein; seeds usually wingless . . . . . *Arabidopsis*

5b. Cauline leaves auriculate to sagittate at base, rarely petiolate; at least some of leaf trichomes dendritic or stellate; fruit valve without or with obscure midvein; seeds often winged . . . . . *Arabis*

4b. Fruits usually terete or 4-angled; cotyledons incumbent.

6a. Inflorescence axis flexuous; leaves divided into 3 or 5 filiform to narrowly linear segments . . . . . *Ianhedgea*

6b. Inflorescence rachis not flexuous; leaves various but never divided into filiform or narrowly linear segments.

7a. Flowers yellow.

8a. Cauline leaves petiolate; fruit apex strongly recurved or contorted; fruiting pedicels stout, nearly as thick as fruit . . . . . *Neotorularia*

8b. Cauline leaves auriculate, rarely sessile; fruit apex neither recurved nor contorted; fruiting pedicels slender, narrower than fruit . . . . *Olimarabidopsis*

7b. Flowers white, lavender, or purple, very rarely creamy white.

9a. Fruits glabrous.

10a. Cauline leaves petiolate; branched trichomes forked, rays always simple.

11a. Fruiting pedicels slender, narrower than fruit; seeds mucilaginous when wetted; fruits straight . . . . . *Arabidopsis*

11b. Fruiting pedicels stout, nearly as thick as fruit; seeds not mucilaginous when wetted; fruits often twisted . . . . . *Neotorularia*

10b. Cauline leaves sessile, often auriculate, sagittate, or amplexicaul, if short petiolate then plants canescent; at least some of the trichomes dendritic or stellate with some branched rays.

12a. All branched trichomes sessile; petals (6–)6.5–8(–9) mm; fruit short stipitate . . . . . *Pseudoarabidopsis*

12b. At least some of the branched trichomes distinctly stalked; petals 1.5–4(–5) mm; fruit sessile.

13a. Seeds biseriate; North America . . . . . *Halimolobos*

13b. Seeds uniseriate; Asia . . . . . *Crucihimalaya*

9b. Fruit pubescent.

14a. Inflorescence bracteate at least on lower half . . . . . *Crucihimalaya*

14b. Inflorescence ebracteate.

15a. Fruit with submalpighiaceous or short-stalked to subsessile stellate trichomes; septum lacking or perforated *Olimarabidopsis*

15b. Fruit with other trichome types; septum complete.

16a. Seeds not mucilaginous when wetted, uniseriate; fruit often strongly torulose and/or twisted; stems often decumbent; predominantly Old World . . . . . *Neotorularia*

16b. Seeds mucilaginous when wetted, mostly biseriate; fruit often smooth; stems not decumbent; exclusively New World . . . . . *Halimolobos*

Crucihimalaya Al-Shehbaz, O'Kane & Price, gen. nov. TYPE: *Crucihimalaya himalaica* (Edgeworth) Al-Shehbaz, O'Kane & Price.

Folia caulina sessilia vel subsessilia, auriculata vel raro nonauriculata; pili ramosi stipitati stellati saepe pilis simplicibus vel furcatis praesentibus; racemi bracteati vel ebracteati, valde elongati; sepala oblonga, nonsaccata; petala alba vel purpurea; fructus lineares, teretes, saepe glabri; stipitum nullum; septum completum; semina uniseriata vel raro biseriata, (15–)20–60(–75) per locula, oblonga, mucilaginosa; cotyledones incumbentes.

Herbs annual or biennial, rarely perennial with a caudex. Trichomes stalked, 1- or 2-forked, often mixed with simple and/or stellate ones, never dendritic. Stems erect to ascending, simple or branched basally and/or apically. Basal leaves rosulate or not, simple, entire or dentate, rarely lyrate or pinnately lobed. Cauline leaves sessile or subsessile, auriculate, sagittate, or rarely cuneate into a petiole-like base, entire, dentate, or rarely pinnately lobed, rarely absent and plants scapose. Inflorescences several- to many-flowered, corymbose racemes, elongated considerably in fruit; rachis straight; bracts present along entire inflorescence, or restricted to lowermost flowers, or absent. Sepals oblong, deciduous, erect, pubescent, base of inner pair not saccate. Petals white, lavender, or purple, spatulate. Stamens 6, slightly tetradynamous; anthers ovate or oblong, sagittate at base, obtuse at apex. Nectar glands confluent and subtending bases of all stamens. Ovules (30–)40–120(–150) per ovary. Fruit dehiscent, linear, terete or somewhat 4-angled to rarely compressed parallel to septum; valves with a distinct midvein, glabrous or rarely stellate hairy or puberulent, smooth or torulose; gynophore absent; septum complete; style to 1 mm long; stigma capitate, entire. Seeds uniseriate or rarely biseriate, (15–)20–60(–75) per locule, wing-

less, oblong, plump; seed coat minutely reticulate, mucilaginous when wetted; cotyledons incumbent.

Crucihimalaya, which means "cross Himalaya," is readily distinguished from *Arabidopsis* by having at least some stalked stellate trichomes (these sometimes mixed with simple or forked ones), sessile and auriculate to sagittate cauline leaves rarely subsessile into a petiole-like base, and bracteate or ebracteate inflorescences. *Arabidopsis* always has stalked forked trichomes, petiolate cauline leaves, and ebracteate inflorescences. Four species of *Crucihimalaya* (*C. axillaris*, *C. himalaica*, *C. lasiocarpa*, and *C. stricta*) have inflorescences bracteate at least on the lower half, and most of the remaining species often have the lowermost flower bracteate. However, this character can be very variable, and the presence of stellate trichomes and/or auriculate to sagittate cauline leaves should help in the separation of such species from *Arabidopsis*.

KEY TO THE SPECIES OF *CRUCIHIMALAYA*

1a. Fruit valves densely and coarsely stellate; pedicels pubescent all around; fruits often subappressed to rachis . . . . . 4. *C. lasiocarpa*
1b. Fruit valves glabrous or very rarely puberulent; pedicels glabrous adaxially, rarely (*C. wallichii*) pubescent all around; fruits not appressed to rachis.
2a. Cauline leaves distinctly auriculate or amplexicaul at base.
3a. Inflorescences bracteate at least along the lower portion; annuals or biennials . . . . . 6. *C. himalaica*
3b. Inflorescences ebracteate; perennials.
4a. Fruits divaricate; plants biennial; adaxial surface of lower cauline leaves predominantly with forked trichomes . . . . . 2. *C. orczinnikovii*
4b. Fruits erect; plants perennial; adaxial surface of lower cauline leaves predominantly with stalked stellate trichomes . . 1. *C. mollissima*
2b. Cauline leaves sessile or subsessile into a petiole-like base, neither auriculate nor amplexicaul, sometimes absent.
5a. Plants scapose; cauline leaves absent or only 1; Mongolia . . . . . 3. *C. mongolica*
5b. Plants with well-developed stems and several cauline leaves; Himalaya and southwest Asia.
6a. Lowermost flowers of main inflorescence bracteate; basal leaves entire to dentate, not canescent, withering by flowering or fruiting.
7a. Stem leaves adaxially with simple and forked trichomes, ovate to elliptic or oblong, rarely oblanceolate; plants 4–15(–20) cm tall; main inflorescence bracteate nearly throughout . . . . . 7. *C. axillaris*
7b. Stem leaves adaxially with stellate stalked trichomes, linear-lanceolate; plants (18–)30–85(–120) cm tall; only lowermost flowers of main inflorescence bracteate . . . . 5. *C. stricta*
6b. Lowermost flowers of main inflorescence ebracteate; basal leaves lyrate to pinnatifid, often canescent, persistent in flower and fruit.
8a. Petals (2–)2.5–3.5(–4.5) mm long; stem base and petioles of basal leaves often with simple trichomes (0.5–)0.8–1.5(–2) mm long; base of lower cauline leaves usually minutely auricled; plants from Nepal and Tibet west into Iran . . . . 8. *C. wallichii*
8b. Petals 4.5–5.5 mm long; stem base and petioles of basal leaves without simple trichomes; base of lower cauline leaves not auricled; plants of Sinai and western Saudi Arabia . . . . . 9. *C. kneuckeri*

1. Crucihimalaya mollissima (C. A. Meyer) Al-Shehbaz, O'Kane & Price, comb. nov. Basionym: *Sisymbrium mollissimum* C. A. Meyer, in Ledebour, Icon. Pl. Fl. Ross. Impr. Altai. Illust. 19. 1831. TYPE: [Russia], Altai, "Hab. in insulis atque ripis fl. Tschuja [Chuya River]," *C. A. Meyer s.n.* (holotype, LE; ?isotypes, P, W).

Distribution. Afghanistan, China, India, Kashmir, Kazakstan, Mongolia, Pakistan, Russia (Siberia), Tajikistan.

Reports of *Crucihimalaya mollissima* (as *Arabidopsis*) from Bhutan by Grierson (1984) and from the Chinese provinces Sichuan and Yunnan by An (1987) were based on misidentified plants of *C. himalaica*. An also reported the species from Gansu and Shaanxi, but we were unable to verify those records.

Schulz (1924) divided the species into eight varieties, of which var. *yunnanensis* O. E. Schulz is based on an immature plant of a species of *Arabis*, var. *afghana* O. E. Schulz is *Crucihimalaya wallichii*, and var. *griffithiana* (Boissier) O. E. Schulz is *Arabis bijuga* Watt. The remaining varieties were based on minor continuous differences in the indumentum and leaf margin and, therefore, do not merit recognition. None of Schulz's eight varieties were recognized in any subsequent taxonomic treatment.

2. Crucihimalaya ovczinnikovii (Botschantsev) Al-Shehbaz, O'Kane & Price, comb. nov. Basionym: *Arabidopsis ovczinnikovii* Botschantsev, in P. N. Ovczinnikov, Fl. Tadzhitskoi SSR 5: 625. 1978. TYPE: Tajikistan. Badachschan, fl. Gunt, canalis Chanif ca. urb. Chorog, 19 June 1966, *R. Kamelin s.n.* (holotype, LE; isotype, LE).

Distribution. Endemic to Tajikistan.

The species is most closely related to and sometimes difficult to separate from *Crucihimalaya mollissima*. The most reliable characters that separate the two species are listed in the key above.

3. Crucihimalaya mongolica (Botschantsev) Al-Shehbaz, O'Kane & Price, comb. nov. Basionym: *Arabis mongolica* Botschantsev, Bot. Zhurn. 60: 947. 1975. TYPE: Central Mongolia. Gobi of Altai Mt., Bain Tzagan, 4 Aug. 1931, *N. P. Ikonnikov-Galitzky & V. A. Ikonnikova-Galitzka 3805* (holotype, LE).

Distribution. Endemic to Mongolia.

Crucihimalaya mongolica is most closely related to *C. mollissima*; it is readily distinguished from this and the remaining species of the genus by the scapose inflorescences and the lack of or presence of a single non-auriculate cauline leaf. The species has incumbent cotyledons, and Botschantsev's (1975) original placement of the species in *Arabis* is erroneous because this genus always has accumbent cotyledons. Měsíček and Soják (1995) were correct in associating the species with *C. mollissima*.

4. Crucihimalaya lasiocarpa (J. D. Hooker & Thomson) Al-Shehbaz, O'Kane & Price, comb. nov. Basionym: *Sisymbrium lasiocarpum* J. D. Hooker & Thomson, J. Linn. Soc., Bot. 5: 162. 1861, not *S. lasiocarpum* F. Mueller, Fragm. 7: 20. 1869. *Sisymbrium bhutanicum* N. P. Balakrishnan, J. Bombay Nat. Hist. Soc. 67: 57. 1970. TYPE: Bhutan. *Griffith s.n.* (lectotype, designated by Jafri (1973), K; isolectotype, BM).

Microsisymbrium duthiei O. E. Schulz, Notizbl. Bot. Gart. Berlin-Dahlem 9: 1089. 1927. Syn. nov. TYPE: India. Kumaon [Uttar Pradesh]: Dhauli Valley, 2300–2650 m, 7 Aug. 1886, *J. F. Duthie 5331* (holotype, DD; photo and fragments, B).

Sisymbrium monachorum W. W. Smith, Rec. Surv. Bot. India 6: 35. 1913. Syn. nov. TYPE: Tibet. Gompa Hill, Gayantse, 25 June 1907, *H. M. Stewart s.n.* (holotype, CAL;? isotype, E).

Arabidopsis lasiocarpa (J. D. Hooker & Thomson) O. E. Schulz var. *micrantha* W. T. Wang, Bull. Bot. Res., Harbin 8(3): 19. 1988. Syn. nov. TYPE: China. Yunnan: Deqin, 3000 m, July–Aug. 1935, *Wang Chi-wu 64727* (holotype, PE; isotype, PE).

Distribution. Bhutan, China, India, Nepal.

Balakrishnan (1970) proposed the name *Sisymbrium bhutanicum* to replace *S. lasiocarpum* J. D. Hooker & Thomson because he erroneously believed that *S. lasiocarpum* F. Mueller was the earlier homonym.

Schulz's (1927) original description of *Microsisymbrium duthiei* matches that of *C. lasiocarpa* in every morphological detail, and it appears that Schulz (1924) never examined any material of *C. lasiocarpa*, a species he placed in *Arabidopsis*. Schulz (1924, 1936) depended solely on the presence vs. absence of seed mucilage to separate *Microsisymbrium* from *Arabidopsis*, and it is likely that he did not observe seed mucilage in the material he described as *M. duthiei*.

5. Crucihimalaya stricta (Cambessèdes) Al-Shehbaz, O'Kane & Price, comb. nov. Basionym: *Malcolmia stricta* Cambessèdes, in Jacquemont, Voy. Ind. Bot. 4: 16. 1844. TYPE: NW Himalaya [India]. Simla (as Semla), *Jacquemont s.n.* (holotype, P; isotype, K).

Arabidopsis stricta (Cambessèdes) N. Busch var. *bracteata* O. E. Schulz, Notizbl. Bot. Gart. Berlin-Dahlem 9: 1061. 1927. Syn. nov. TYPE: [India]. Kumaun, Deopata, Naini Tál, 2300 m, 4 July 1885, *J. F. Duthie 3835* (holotype, B).

Distribution. China, India, Kashmir, Nepal, Pakistan.

An's (1987) report of *Crucihimalaya stricta* (as *Arabidopsis stricta*) from Sichuan is based on misidentification of plants of *C. himalaica*. The reports in Schulz (1924), Jafri (1973), and Hajra et al. (1993) of the species from Afghanistan were based on collections (*Aitchinson 210* and *251*, BM and K) from Pakistan. A duplicate specimen at K of the Jacquemont collection from India (no locality was given, but it bears the numbers 2188 and "(786)") is definitely *C. himalaica* because it has large-auricled leaves and bracts. It is not part of the type collection of *C. stricta*, a species that never has auriculate leaves or bracts.

Crucihimalaya stricta was not reported from Nepal (Hara, 1979), though Schulz (1927) cited one collection (*Duthie 5352*) from Budhi village in western Nepal. We have examined another collection, *Stainton, Sykes & Williams 3365* (BM, E, G), that was collected from Jagat and misidentified as *Arabidopsis mollissima*.

6. Crucihimalaya himalaica (Edgeworth) Al-Shehbaz, O'Kane & Price, comb. nov. Basionym: *Arabis himalaica* Edgeworth, Trans. Linn. Soc. 20: 31. 1846. TYPE: [India]. "In glareosis Himala, alt. ped. 10,000–11,000, Mana," *Edgeworth s.n.* (holotype, K).

Arabis brevicaulis Jafri, Notes Roy. Bot. Gard. Edinburgh 22: 99. 1956. Syn. nov. TYPE: NW Himalaya. Karakorum, Zangia Harar, Hunza Valley, 3600 m, 5 July 1939, *R. S. Russell 1066* (holotype, BM).

Distribution. Afghanistan, Bhutan, China, India, Kashmir, Nepal, Pakistan, Sikkim.

Arabis brevicaulis was transferred by Jafri (1973) to *Arabidopsis*. He admitted that the species could conceivably be placed in *A. mollissima*. The specimens cited by Jafri under *A. mollissima* clearly represent a mixture of that species and *A. himalaica*. One of the specimens, *Bowes Lyon 849* (BM), was annotated by Jafri as the holotype of *Arabidopsis chitralica* Jafri, a name that was never published. The specimen was cited by Jafri (1973) as *A. mollissima*, and it is most likely the same as the type of *Arabis brevicaulis*.

On the basis of cited specimens, both *Arabidopsis himalaica* and *A. mollissima* were confused by Schulz (1924), Hedge (in Hedge & Rechinger, 1968), and Jafri (1973). The principal character used by these authors to separate these two species is the presence in *A. himalaica* of bracts along the entire length of the inflorescences and the lack in *A. mollissima* of bracts or their restriction to the lowermost few flowers of the inflorescence. However, this character shows tremendous variability in the same population or even on the same plant. In most plants of *A. himalaica* the uppermost portion of the inflorescence is ebracteate. For example, in *Lowndes 1166* (BM) one plant has the lowermost 24 flowers bracteate and another has only the lowermost 4 bracteate. In *Stewart 17986* (US) one plant has almost ebracteate inflorescences and another has fully bracteate inflorescences. Plants of *Crucihimalaya himalaica* are annual or biennial with coarse stellate and forked trichomes, at least basally bracteate inflorescences, slender fruits (0.4–)0.5–0.8(–1) mm wide, and seeds 0.5–0.8 mm long. By contrast, plants of *C. mollissima* are perennial with soft stellate trichomes, ebracteate inflorescences, fruits 1–1.5 mm wide, and seeds 0.8–1.1 mm long.

Plants from Chitral (Pakistan) treated by Jafri (1956, 1973) as *Arabis brevicaulis* and *Arabidopsis brevicaulis*, respectively, differ from typical *C. himalaica* in being perennials with only the basal one or two flowers bracteate, but they are perfectly at home in the species in trichome type, fruit width, and seed length. They might be recognized at the subspecific rank, but more material is needed for a sound conclusion to be reached.

7. Crucihimalaya axillaris (J. D. Hooker & Thomson) Al-Shehbaz, O'Kane & Price, comb. nov. Basionym: *Sisymbrium axillare* J. D. Hooker & Thomson, J. Linn. Soc., Bot. 5: 162. 1861. TYPE: Sikkim. Alt. 8,000–10,000 ft., *J. D. Hooker s.n.* (lectotype, designated by Jafri (1956), K; isolectotypes, B, G, W).

Microsisymbrium axillare (J. D. Hooker & Thomson) O. E. Schulz var. *brevipedicellatum* Jafri, Notes Roy. Bot. Gard. Edinburgh 22: 112. 1956. Syn. nov. TYPE: India. Lahul, Keylang, 3600 m, 8 June 1889, *G. Watt 2433* (holotype, E).

Microsisymbrium axillare var. *dasycarpum* O. E. Schulz, Pflanzenreich IV. 105(Heft 86): 160. 1924. Syn. nov. TYPE: Bhutan. *Griffith 1383* (holotype, CAL?; isotypes, K, P, W).

Microsisymbrium bracteosum Jafri, Notes Roy. Bot. Gard. Edinburgh 22: 112. 1956. Syn. nov. TYPE: India. Kuymaon, Bynas, ca. 2400 m, Apr. 1881, *J. R. Reid s.n.* (holotype, E).

Distribution. Bhutan, China, India, Kashmir, Nepal, Sikkim.

Schulz (1924) recognized plants with puberulent fruits as variety *dasycarpum*, but both glabrous and puberulent fruits can be found in the same population. Robust plants of this species were described by Jafri (1956) as *Microsisymbrium bracteosum*, while those with short pedicels and ebracteate uppermost flowers were described as *M. axillare* var. *brevipedicellatum*. However, these characters show continuous variation and, therefore, these two taxa do not merit recognition.

8. Crucihimalaya wallichii (J. D. Hooker & Thomson) Al-Shehbaz, O'Kane & Price, comb. nov. Basionym: *Sisymbrium wallichii* J. D. Hooker & Thomson, J. Linn. Soc., Bot. 5: 158. 1861. TYPE: [India]. Kumaon, *Wallich 4784* (lectotype, designated by Jafri (1973), K; isolectotype, BM).

Arabidopsis mollissima (C. A. Meyer) O. E. Schulz var. *afghanica* O. E. Schulz, Pflanzenreich IV. 105(Heft 86): 281. 1924. Syn. nov. TYPE: Afghanistan. *Griffith 1470* (holotype, K).

Arabidopsis russelliana Jafri, Notes Roy. Bot. Gard. Edinburgh 22: 97. 1956. Syn. nov. TYPE: Karakorum, Kero Lugma glacier, 3900 m, 27 July 1939, *R. S. Russell 1855* (holotype, BM).

Distribution. Afghanistan, Bhutan, China, India, Iran, Kashmir, Kazakstan, Kyrgyzstan, Nepal, Pakistan, Tajikistan, Turkmenistan, Uzbekistan.

Crucihimalaya wallichii is the most variable species in the genus, especially in the density of indumentum, division of basal and cauline leaves, length of fruiting pedicels, and length and degree of compression of fruit. The continuous variation in these characters has been adequately described by Hedge (in Hedge & Rechinger, 1968), and it is evident that no infraspecific taxa can be recognized. However, Jafri (1973) segregated two additional species, as *Arabidopsis taraxacifolia* (T. Anderson) Jafri and *A. russelliana* Jafri, based primarily on differences in the degrees of stem branching, style length, and petal size. In our opinion, these highly variable characters are unreliable and, therefore, these segregates do not merit recognition at any rank.

Crucihimalaya wallichii is closely related to *C. kneuckeri*, and the two species can be separated only by the characters in the key above.

Schulz (1927), in his original description of *Microsisymbrium flaccidum* O. E. Schulz, cited two syntypes, *Duthie 11055* and *Inayat 19172*, both of which are deposited at DD, with photos and fragments at B. The former collection was designated by Jafri (1973) as the lectotype, and there is an isolectotype at K. This is definitely an immature plant of a species of *Arabis*. The second collection, *Inayat 19172*, is a glabrescent form of *Crucihimalaya wallichii* with slightly lyrate leaves and incumbent cotyledons.

9. Crucihimalaya kneuckeri (Bornmüller) Al-Shehbaz, O'Kane & Price, comb. nov. Basionym: *Sisymbrium kneuckeri* Bornmüller, in A. Kneucker, Allgem. Bot. Zeitschr. 9: 45. 1904. TYPE: [Egypt]. Mt. Sinai, Dschebel Katharin, 5 Apr. 1902, *A. Kneucker s.n.* (holotype, JE; isotype, B).

Distribution. Saudi Arabia, Egypt (Sinai).

Schulz (1924) mixed the flower size of *Crucihimalaya kneuckeri* with that of *C. wallichii*. The latter has flowers as small as 2 mm long. More material of *C. kneuckeri* is needed to fully assess its overall variation.

Olimarabidopsis Al-Shehbaz, O'Kane & Price, gen. nov. TYPE: *Olimarabidopsis pumila* (Stephan) Al-Shehbaz, O'Kane & Price.

Folia caulina sessilia, minute vel valde auriculata; pili ramosi sessiles vel minute stipitati malpighiacei vel stellati, ramis simplicibus; racemi ebracteati, valde elongati; sepala oblonga, nonsaccata; petala flava; fructus lineares, teretes, saepe stellati vel malpighiacei; stipitum nullum; septum nullum vel perforatum vel completum; semina uniseriata, 9–30 per locula, oblonga, mucilaginosa; cotyledones incumbentes.

Herbs annual. Trichomes short-stalked or sessile, malpighiaceous and 3- or 4-rayed stellate. Stems erect to ascending, sometimes decumbent, simple or branched basally and/or apically. Basal leaves not rosulate, simple, entire or very rarely pinnately dissected. Cauline leaves sessile, minutely to conspicuously auriculate, entire to dentate. Inflorescences few- to several-flowered, ebracteate, corymbose racemes, elongated considerably or rarely slightly elongated in fruit; rachis straight. Sepals oblong, deciduous, erect, glabrous or pubescent, base of inner pair not saccate. Petals yellow or yellowish white, oblanceolate. Stamens 4 or 6 and only slightly tetradynamous; anthers oblong, rounded at base, obtuse at apex. Nectar glands confluent and subtending bases of all stamens. Ovules 18–60 per ovary. Fruit dehiscent, linear, terete; valves with a distinct midvein, pubescent with exclusively malpighiaceous and/or short-stalked stellate trichomes; gynophore absent; septum complete, perforated, or reduced to a rim; style obsolete or distinct and to 1 mm long; stigma capitate, entire. Seeds uniseriate, wingless, oblong, plump; seed coat minutely reticulate, slightly mucilaginous or not mucilaginous when wetted; cotyledons incumbent.

As delimited here, *Olimarabidopsis*, which means "formerly *Arabidopsis*," consists of three species all of which were previously placed in *Arabidopsis*. One of those species was described twice under two genera (as *Trichochiton umbrosum* Botschantsev & Vvedensky and 20 years later (see below) as *Arabidopsis eseptata* Hedge). The two questions most relevant to *Olimarabidopsis* are: First, is *Trichochiton* distinct from the closely related and earlier published *Cryptospora* Karelin & Kirilow? Second, is *T. umbrosum* correctly assigned to this genus? All species of *Cryptospora* have 2-lobed stigmas, large seeds 2.5–4.5 mm long, indehiscent fruits that break up at maturity into 1-seeded segments, some simple trichomes on the leaves and/or stems, white to lavender flowers, and non-auriculate cauline leaves (Botschantsev, 1963). The type species of *Trichochiton*, *T. inconspicuum* Komarov, has all of these characters. Therefore, we fully agree with Schulz (1936) and Rechinger (in Hedge & Rechinger, 1968) in reducing *Trichochiton* to synonymy of *Cryptospora* and in recognizing its type as *C. inconspicua* (Komarov) O. E. Schulz.

The answer to the second question is no. *Trichochiton umbrosum* has entire stigmas, small seeds to 1.3 mm long, readily dehiscent fruits, exclusively

stellate and malpighiaceous (never simple) trichomes, pale yellow flowers, and minutely auriculate cauline leaves. In our opinion, these differences are substantial, and *T. umbrosum* (= *Arabidopsis eseptata*) is herein assigned to a new genus, *Olimarabidopsis*, of three very closely related species.

Olimarabidopsis is readily distinguished from *Arabidopsis* by having yellow flowers, auriculate cauline leaves, and pubescent fruits. In contrast, *Arabidopsis* has white to lavender flowers, short petiolate stem leaves, and glabrous fruits. *Olimarabidopsis* is distinguished from small-flowered species of the closely related genus *Erysimum* by its auriculate cauline leaves and short-stalked branched trichomes. All species of *Erysimum* have petiolate cauline leaves and malpighiaceous and/or sessile 3–5-rayed stellate trichomes.

KEY TO THE SPECIES OF *OLIMARABIDOPSIS*

1a. Trichomes on fruit valve exclusively submalpighiaceous; seeds 1–1.3 mm long; fruit attenuate to apex; style obsolete; stamens 4 or rarely 6 . . . . . 3. *O. umbrosa*

1b. At least some of the fruit trichomes 3- or 4-rayed; seeds less than 1 mm long; fruit cuneate to apex; style distinct; stamens 6.

2a. Septum perforate; fruit 0.4–1(–1.5) cm long, 5–18(–20)-seeded . . . . . 2. *O. cabulica*

2b. Septum complete; fruit 1.5–3.2(–4) cm, (15–)22–40(–60)-seeded . . . . . 1. *O. pumila*

1. Olimarabidopsis pumila (Stephan) Al-Shehbaz, O'Kane & Price, comb. nov. Basionym: *Sisymbrium pumilum* Stephan, in Willdenow, Sp. Pl. ed. 4, 3(1): 507. 1800. TYPE: N Persia. [Kizlar], *Stephan s.n.* (holotype, LE; isotype, W).

Distribution. Afghanistan, Armenia, Azerbaijan, China, Georgia, India, Iran, Iraq, Israel, Jordan, Kazakstan, Kyrgyzstan, Lebanon, Oman, Pakistan, Russia, Syria, Tajikistan, Turkmenistan, Turkey, Uzbekistan.

Sisymbrium griffithianum Boissier was transferred to *Microsisymbrium* by Schulz (1924). An examination of the type and numerous other collections clearly shows that the species is a minor variant of *Olimarabidopsis pumila* with strongly reflexed instead of divaricate to ascending fruits. In fact, plants with reflexed and divaricate to ascending fruits are commonly found in the same population, as evidenced by *Botschantsev 111* (LE) from Uzbekistan, *Hedge & Wendelbo 2901* (E) from Afghanistan, and *Lammond 1026* (E, LE) from Pakistan. It is surprising, therefore, to have the same species cited by Schulz (1924) under two different genera, as *M. griffithianum* and *Arabidopsis pumila*. We agree with Hedge (in Hedge & Rechinger, 1968) in reducing *S. griffithianum* to synonymy of *Olimarabidopsis pumila* (as *A. pumila*).

2. Olimarabidopsis cabulica (J. D. Hooker & Thomson) Al-Shehbaz, O'Kane & Price, comb. nov. Basionym: *Sisymbrium cabulicum* J. D. Hooker & Thomson, J. Linn. Soc., Bot. 5: 161. 1861. TYPE: Afghanistan. *Griffith* [*1465*] (holotype, K).

Arabidopsis korshinskyi Botschantsev, Novit. Syst. Pl. Vasc. Acad. Sci. URSS 1965: 272. 1965. Syn. nov. TYPE: [Tajikistan]. Alaica Valley, near Katyn-Art, stony Kyzylsu, 13 July 1895, *S. Korshinsky 304* (holotype, LE).

Distribution. Afghanistan, W China, Kyrgyzstan, Tajikistan.

The type and other collections annotated by Botschantsev as *Arabidopsis korshinskyi* are indistinguishable from the type of *Sisymbrium cabulicum*. The latter was reduced by Jafri (1973) to synonymy of *Arabidopsis pumila*. However, the perforate septum, shorter fruits, and fewer seeds per locule (see the key above) readily distinguish plants of the two species herein placed in *Olimarabidopsis*. Furthermore, *O. cabulica* (reported as *A. korshinskyi*) is a hexaploid ($2n = 48$), whereas *O. pumila* is tetraploid ($2n = 32$) (Aryavand, 1983; Ginter & Ivanov, 1968; Polatschek, 1971).

An (1987) reported the species (as *Arabidopsis pumila* (Stephan) N. Busch var. *alpina* (Korshinsky) O. E. Schulz) from Xinjiang, but we have not seen any material from China.

3. Olimarabidopsis umbrosa (Botschantsev & Vvedensky) Al-Shehbaz, O'Kane & Price, comb. nov. Basionym: *Trichochiton umbrosum* Botschantsev & Vvedensky, Not. Syst. Herb. Inst. Bot. & Zool. Acad. Sci. Uzbekistan 12: 10. 1948. TYPE: [Tajikistan]. Samarkand region, shady places around Lake Koli-Kalan, 16 June 1916, *Lipsky s.n.* (holotype, TASH).

Distribution. Afghanistan, Tajikistan, Uzbekistan.

Arabidopsis eseptata Hedge was correctly reduced to synonymy of *Trichochiton umbrosum* by Pachomova (1974) and Junussov (1978), but Pachomova erroneously cited the authorship of the species by considering it as a new combination based on Komarov's (1896) *T. inconspicuum* var. *umbrosum* Komarov. Although they selected the same epithet for the species, Botschantsev and Vvedensky (1948) treated *T. umbrosum* as a new species and cited a holotype collected 22 years after Komarov's publication.

Pseudoarabidopsis Al-Shehbaz, O'Kane & Price, gen. nov. TYPE: *Pseudoarabidopsis toxophylla* (Bieberstein) Al-Shehbaz, O'Kane & Price.

Folia caulina sessilia, sagittato-amplexicaulia vel raro auriculata; pili ramosi sessiles stellati, ramis ramosis; racemi ebracteati, valde elongati; sepala oblonga, subsaccata; petala alba vel lavandula; fructus lineares, teretes, glabri; stipitum distinctum; septum completum; semina biseriata, 30–50 per locula, oblonga, mucilaginosa; cotyledones incumbentes.

Herbs biennial or perennial. Trichomes sessile, stellate, 4- or 5-rayed, with at least some rays branched. Stems erect to ascending, simple or branched basally. Basal leaves rosulate, often withered by fruiting time, simple, entire or dentate. Cauline leaves sessile, deeply sagittate-amplexicaul or rarely auriculate, entire to dentate. Inflorescences several-flowered, ebracteate, corymbose racemes, elongated considerably in fruit; rachis straight. Sepals oblong, deciduous, erect, glabrous or pubescent, base of inner slightly saccate. Petals white to lavender, spatulate. Stamens 6, prominently tetradynamous; anthers oblong, sagittate at base, obtuse at apex. Nectar glands confluent, subtending bases of all stamens, surrounding those of lateral ones. Ovules 60–100 per ovary. Fruit dehiscent, linear, terete; valves with obscure midvein, glabrous; gynophore distinct; septum complete; style distinct and to 1 mm long; stigma capitate, entire or slightly 2-lobed. Seeds biseriate, 30–50 per locule, wingless, oblong to ovoid, plump; seed coat minutely reticulate, slightly mucilaginous when wetted; cotyledons incumbent.

Pseudoarabidopsis is readily distinguished from *Arabidopsis* and *Erysimum* by having sessile, sagittate-amplexicaul cauline leaves, exclusively sessile, stellate trichomes with branched rays, and a distinct gynophore. In *Arabidopsis* the leaves are petiolate and never amplexicaul or sagittate, the trichomes are simple mixed with stalked forked ones, and the fruits are sessile or subsessile. In its stellate trichomes and sagittate-amplexicaul cauline leaves, *P. toxophylla* resembles *Capsella bursa-pastoris* (L.) Medikus. Although drastically different in fruit morphology, these two species show remarkable affinities on the basis of ITS results.

Pseudoarabidopsis toxophylla (Bieberstein) Al-Shehbaz, O'Kane & Price, comb. nov. Basionym: *Arabis toxophylla* Bieberstein, Fl. Taur.-Cauc. 3: 448. 1819. TYPE: Not designated. Busch (1939) selected the specimen collected from Perekop and housed at LE as the type. We have not seen this specimen.

Distribution. Afghanistan, western China, Kazakstan, Russia, Tajikistan.

Generic Placement of Species Previously Included in *Arabidopsis*

The following 59 binomials previously assigned to *Arabidopsis* are assigned to 14 genera, including *Arabidopsis*. Accepted taxa are in boldface, and synonyms, excluded, or doubtful taxa are in italics. Binomials marked with (*) are proposed in this paper.

Arabidopsis arenosa (L.) Lawalrée, Bull. Soc. Roy. Bot. Belg. 92: 242. 1960.

A. bactriana Ovczinnikov & Junussov, Fl. Tadzhitskoi SSR 5: 626. 1978. No material has been seen, but according to the original description, the species cannot be assigned to *Arabidopsis* because it is a pulvinate, scapose perennial with cylindric fruits, subbiseriate seeds, and leafless stems. It is likely that the plant belongs to *Crucihimalaya mongolica*.

A. brevicaulis (Jafri) Jafri, Fl. W. Pakistan 55: 272. 1973. = **Crucihimalaya himalaica** (Edgeworth) Al-Shehbaz, O'Kane & Price (*).

A. bursifolia (DC.) Botschantsev, Not. Syst. Herb. Inst. Bot. Acad. Sci. URSS 19: 106. 1959. The systematic position of this species is problematic and awaits further study. Berkutenko (1988) suggested that the North American (Greenland, Yukon, and Alaska) *Arabidopsis mollis* (Hooker) O. E. Schulz, which Rollins (1943, 1952, 1993) treated as *Halimolobos mollis* (Hooker) Rollins, is probably the same as Russian (Far East) *A. bursifolia* (DC.) Botschantsev and that *A. tschuktschorum* (Jurtzev) Jurtzev, which is known only from the type locality at Chegiton River (Chukutka), is probably an abnormal plant of *A. bursifolia*. Although *A. bursifolia* and *H. mollis* may well prove to be conspecific, we have not yet conducted extensive study on them, and our work on *Halimolobos* is still in progress. However, we are certain that none of these species belongs to *Arabidopsis*.

A. campestris O. E. Schulz, Notizbl. Bot. Gart. Berlin-Dahlem 9: 1059. 1927. = **Crucihimalaya wallichii** (J. D. Hooker & Thomson) Al-Shehbaz, O'Kane & Price (*).

A. cebennensis (DC.) O'Kane & Al-Shehbaz, Novon 7: 325. 1997.

A. croatica (Schott) O'Kane & Al-Shehbaz, Novon 7: 325. 1997.

A. dentata (Allioni) Dalla Torre, Alpenfl. 115. 1899. = **Murbeckiella pinnatifida** (Lamarck) Rothmaler, Bot. Not. 1939: 469. 1939.

A. drassiana Naqshi & Javeid, J. Econ. Taxon. Bot. 7: 624. 1986. No material has been seen. The species is excluded from *Arabidopsis* because it has sessile amplexicaul leaves. Naqshi and Javeid (1986) provided an incomplete description and gave no mention of the type of trichomes, which are very important in the *Arabidopsis* complex, and whether the fruits are terete or flattened. Because they indicated that the linear fruits include only one or two seeds, it is possible that the plant is of hybrid origin.

A. erysimoides Hedge & Kit Tan, Pl. Syst. Evol. 156: 202. 1987. = **Erysimum hedgeanum** Al-Shehbaz, Novon 4: 1. 1994.

A. eseptata Hedge, Fl. Iran. 57: 334. 1968. = **Olimarabidopsis umbrosa** (Botschantsev & Vvedensky) Al-Shehbaz, O'Kane & Price (*).

A. gamosepala Hedge, Fl. Iran. 57: 334. 1968. = **Neotorularia gamosepala** (Hedge) Al-Shehbaz & O'Kane, Novon 7: 93. 1997.

A. glauca (Nuttall ex Torrey & A. Gray) Rydberg, Fl. Rocky Mt. 342. 1917. = **Thellungiella salsuginea** (Pallas) O. E. Schulz, Pflanzenr. IV. 105(Heft 86): 252. 1924.

A. griffithiana (Boissier) N. Busch, Fl. Cauc. Crit. 3(4): 457. 1909. = **Olimarabidopsis pumila** (Stephan) Al-Shehbaz, O'Kane & Price (*).

A. halleri (L.) O'Kane & Al-Shehbaz, Novon 7: 325. 1997.

A. himalaica (Edgeworth) O. E. Schulz, Pflanzenreich IV.105(Heft 86): 283. 1924. = **Crucihimalaya himalaica** (Edgeworth) Al-Shehbaz, O'Kane & Price (*).

A. huetii (Boissier) N. Busch, Acta Hort. Petrop. 28: 389. 1908. = **Murbeckiella huetii** (Boissier) Rothmaler, Bot. Not. 1939: 472. 1939.

A. kneuckeri (Bornmüller) O. E. Schulz, Pflanzenr. IV. 105(Heft 86): 277. 1924. = **Crucihimalaya kneuckeri** (Bornmüller) Al-Shehbaz, O'Kane & Price (*).

A. korshinskyi Botschantsev, Novit. Syst. Pl. Vasc. Acad. Sci. URSS 1965: 272. 1965. = **Olimarabidopsis cabulica** (J. D. Hooker & Thomson) Al-Shehbaz, O'Kane & Price (*).

A. lasiocarpa (J. D. Hooker & Thomson) O. E. Schulz, Pflanzenr. IV. 105(Heft 86): 282. 1924. = **Crucihimalaya lasiocarpa** (J. D. Hooker & Thomson) Al-Shehbaz, O'Kane & Price (*).

A. lyrata (L.) O'Kane & Al-Shehbaz, Novon 7: 325. 1997.

A. minutiflora (J. D. Hooker & Thomson) N. Busch, Fl Cauc. Crit. 3(4): 457. 1909 = **Ianhedgea minutiflora** (J. D. Hooker & Thomson) Al-Shehbaz & O'Kane, Edinb. J. Bot. (1999 in press).

A. mollis (Hooker) O. E. Schulz, Bot. Jahrb. Syst. 66: 97. 1933. = **Halimolobos mollis** (Hooker) Rollins, Rhodora 43: 480. 1941.

A. mollissima (C. A. Meyer) N. Busch, Fl. Sib. Or. Extr. 1: 136. 1913. = **Crucihimalaya mollissima** (C. A. Meyer) Al-Shehbaz, O'Kane & Price (*).

A. monachorum (W. W. Smith) O. E. Schulz, Pflanzenr. IV. 105(Heft 86): 282. 1924. = **Crucihimalaya lasiocarpa** (W. W. Smith) Al-Shehbaz, O'Kane & Price (*).

A. mongolica (Botschantsev) Měsiček & Soják, Folia Geobot. Phytotax. 30: 448. 1995. = **Crucihimalaya mongolica** (Botschantsev) Al-Shehbaz, O'Kane & Price (*).

A. multicaulis Pampanini, Sped. Ital. DeDilippi Himal., etc. 1913–1914, Ser. 2, 11 (Agg. Fl. Carac.): 160. 1934. = **Arabis tibetica** J. D. Hooker & Thomson, J. Linn. Soc., Bot. 5: 143. 1861.

A. neglecta (Schultes) O'Kane & Al-Shehbaz, Novon 7: 326. 1997.

A. novae-anglicae Britton, in Britton & Brown, Illus. Fl., ed. 2, 2: 176. 1913. = **Neotorularia humilis** (C. A. Meyer) Hedge & J. Léonard, Bull. Jard. Bot. Nat. Belg. 56: 394. 1986.

A. nuda (Bélanger) Bornmüller, Beih. Bot. Zentralbl. 33(2): 275. 1915. = **Drabopsis nuda** (Bélanger) Stapf, Denkschr. Akad. Wiss. Wien, Math.-Nat. Kl. 51(2): 298. 1886.

A. ovczinnikovii Botschantsev, in P. N. Ovczinnikov, Fl. Tadzhitskoi SSR 5: 625. 1978. = **Crucihimalaya ovczinnikovii** (Botschantsev) Al-Shehbaz, O'Kane & Price (*).

A. parvula (Schrenk) O. E. Schulz, Pflanzenr. IV. 105(Heft 86): 269. 1924. = **Thellungiella parvula** (Schrenk) Al-Shehbaz & O'Kane, Novon 5: 309. 1995.

A. pedemontana (Boissier) O'Kane & Al-Shehbaz, Novon 7: 326. 1997.

A. pinnatifida (Lamarck) Ruprecht, Mém. Acad. Sci. St. Pétersb. Ser. 7, 15(2): 86. 1869. = **Murbeckiella pinnatifida** (Lamarck) Rothmaler, Bot. Not. 1939: 469. 1939.

A. pumila (Stephan) N. Busch, Fl. Cauc. Crit. 3(4): 457. 1909. = **Olimarabidopsis pumila** (Stephan) Al-Shehbaz, O'Kane & Price (*).

A. qiranica Z. X. An, Fl. Xinjiang. 2(2): 376. 1995. = **Sisymbriopsis mollipila** (Maximowicz) Botschantsev, Nov. Syst. Pl. Vasc. 3: 122. 1966.

A. richardsonii (Rydberg) Rydberg, Fl. Rocky Mt. 341. 1917. = **Neotorularia humilis** (C. A. Meyer) Hedge & J. Léonard, Bull. Jard. Bot. Nat. Belg. 56: 394. 1986.

A. russeliana Jafri, Notes Roy. Bot. Gard. Edinb. 22: 97. 1956. = **Crucihimalaya wallichii** (J. D. Hooker & Thomson) Al-Shehbaz, O'Kane & Price (*).

A. salsuginea (Pallas) N. Busch, Fl. Sib. 1: 136. 1913. = **Thellungiella salsuginea** (Pallas) O. E. Schulz, Pflanzenr. IV. 105(Heft 86): 252. 1924.

A. sarbalica Naqshi & Javeid, J. Econ. Taxon. Bot. 7: 621. 1985 (1986). No material has been seen. The species is excluded from *Arabidopsis* because the cauline leaves are minutely auriculate. The original description and illustration clearly support placing the species in *Crucihimalaya wallichii*. Naqshi and Javeid (1986) separated *A. sarbalica* from *A. wallichii* because the former has shorter fruits 2.5–3.2 mm long, but this fruit length falls within that of *C. wallichii*.

A. schimperi (Boissier) N. Busch, Fl. Cauc. Crit. 3(4): 457. 1909. = **Robeschia schimperi** (Boissier) O. E. Schulz, Pflanzenr. IV. 105(Heft 86): 360. 1924.

A. stenocarpa Rydberg, Torrea 7: 160. 1907. = **Halimolobos virgata** (Nuttall ex Torrey & A. Gray) O. E. Schulz, Pflanzenr. IV. 105(Heft 86): 290. 1924.

A. stewartiana Jafri, Notes Roy. Bot. Gard. Edinburgh 22: 96. 1956. We have not seen any material of this species. Jafri (1956) distinguished it from *Olimarabidopsis pumila* (as *A. pumila*) on the basis of having semi-amplexicaul instead of sagittate-amplexicaul leaves and glabrous instead of pubescent fruits. Leaf base is extremely variable in *O. pumila*, and glabrous fruits, which are very rare in the species, can be found in populations that have predominantly pubescent fruits. Because of the bright yellow flowers, the species does not belong to *Arabidopsis*. The detailed original description of *A. stewartiana* leaves no doubt that it is a minor variant of *O. pumila*.

A. stricta (Cambessèdes) N. Busch, Fl. Cauc. Crit. 3(4): 457. 1909. = **Crucihimalaya stricta** (Cambessèdes) Al-Shehbaz, O'Kane & Price (*).

A. suecica (Fries) Norrlin, Meddel. Soc. Fauna Fl. Fenn. 2: 12. 1878.

A. taraxacifolia (T. Anderson) Jafri, Fl. W. Pakistan, 55: 274. 1973. = **Crucihimalaya wallichii** (J. D. Hooker & Thomson) Al-Shehbaz, O'Kane & Price (*). For an excellent discussion on the variation in this species and synonymy, see Hedge (in Hedge & Rechinger, 1968).

A. tenuisiliqua (K. H. Rechinger & Köie) Jafri, Fl. W. Pakistan 55: 171. 1973. = **Arabis tenuisiliqua** K. H. Rechinger & Köie, Anz. Math.-Nat. Kl. Oesterr. Akad. Wiss. 7: 5. 1954. We have not seen the type or any material of this species, and we are following Hedge (in Hedge & Rechinger, 1968) in maintaining it in *Arabis*, though the species is anomalous in that genus because of its incumbent cotyledons. It is excluded from *Arabidopsis* because it has stellate fruit trichomes, and no species of this genus has stellate hairs or pubescent fruits. Therefore, Jafri's (1973) transfer of the species is unacceptable. It is likely that the species is related to *Crucihimalaya wallichii*, from which it differs by having larger flowers and smaller fruit.

A. thaliana (L.) Heynhold, in Holl & Heynhold, Clav. Gen. Fl. Sachsen 1: 538. 1842.

A. tibetica Naqshi & Javeid, J. Econ. Taxon. Bot. 7: 621. 1985 (1986). We have not seen the type of this species, but the name is illegitimate because it is a later homonym of the following species. The plant is excluded from *Arabidopsis* because it is a perennial with stellate trichomes. Naqshi and Javeid (1986) considered the species to be closely related to *Crucihimalaya himalaica* (as *A. himalaica*) and distinguished solely on the basis of having non-auriculate, distinctly veined cauline leaves. It remains to be seen whether or not the two are conspecific.

A. tibetica (J. D. Hooker & Thomson) Lan & C. H. An ex K. C. Kuan, Fl. Xizang. 2: 372. 1985. = **Arabis tibetica** J. D. Hooker & Thomson, J. Linn. Soc., Bot. 5: 143. 1861.

A. toxophylla (Bieberstein) N. Busch, Fl. Cauc. Crit. 3(4): 457. 1909. = **Pseudoarabidopsis toxophylla** (Bieberstein) Al-Shehbaz, O'Kane & Price (*).

A. trichocarpa R. F. Huang, in S. W. Liu, Fl. Qinghaica 1: 509. 1997. We have examined the holotype of this species, and on the basis of its pubescent fruits and bracteate lowermost portion of inflorescences, the species is excluded from *Arabidopsis*. The plant is a minor variant of *Neotorularia humilis* (C. A. Meyer) Hedge & Léonard.

A. trichopoda (Turczaninow) Botschantsev, Not. Syst. Herb. Inst. Bot. Acad. Sci. URSS 18: 104. 1957. Botschantsev (1959) was correct in his placement of this species in synonymy of *Arabidopsis bursifolia*. See discussion under this species.

A. tschuktschorum (Jurtsev) Jurtsev, Bot. Zhurn. 60: 240. 1975. See discussion under *Arabidopsis bursifolia*.

A. tuemurnica K. C. Kuan & C. H. An, Bull. Bot. Lab. North-East Forest. Inst. 1980(8): 44. 1980. = **Neotorularia humilis** (C. A. Meyer) Hedge & J. Léonard, Bull. Jard. Bot. Nat. Belg. 56: 394. 1986.

A. verna (Koch) N. Busch, Fl. Cauc. Crit. 3(4): 460. 1909. = **Drabopsis nuda** (Bélanger) Stapf, Denkschr. Akad. Wiss. Wien, Math.-Nat. Kl. 51(2): 298. 1886.

A. virgata (Nuttall ex Torrey & A. Gray) Rydberg, Fl. Rocky Mt. 342. 1917. = **Halimolobos virgata** (Nuttall ex Torrey & A. Gray) O. E. Schulz, Pflanzenr. IV. 105(Heft 86): 290. 1924.

A. wallichii (J. D. Hooker & Thomson) N. Busch, Fl. Cauc. Crit. 3(4): 457. 1909. = **Crucihimalaya wallichii** (J. D. Hooker & Thomson) Al-Shehbaz, O'Kane & Price (*).

A. yadungensis K. C. Kuan & C. H. An, Fl. Xizang. 2: 375. 1985. An examination of the type collection reveals that the species is definitely a member of the *Arabis hirsuta* (L.) Scopoli complex. The immature fruits are strongly compressed and subappressed to rachis, and the cauline leaves are strongly auriculate, all of which are characters not found in any *Arabidopsis* species. The species is under study by the senior author in connection with the *Flora of China* project.

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A Revision of *Sisymbriopsis* (Brassicaceae)

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ABSTRACT. The genus *Sisymbriopsis* is established, and a key, descriptions, and distributions of the five species are given. The new combinations *S. pamirica*, *S. shuanghuica*, and *S. yechengnica* are proposed.

During work on the Brassicaceae (Cruciferae) for the *Flora of China*, it became evident that the placement of many Chinese species fluctuated between different genera, and no clear lines have been drawn to delimit them. The present paper deals with the placement of four such species, plus a fifth endemic to Tajikistan.

In their original description of *Sisymbriopsis*, Botschantsev and Tzvelev (1961) recognized a single species, *S. schugnana* Botschantsev & Tzvelev, which was mistakenly treated and illustrated by Vassilczenko (1939) as *Torularia mollipila* (Maximowicz) O. E. Schulz. Botschantsev (1966) transferred the latter species to *Sisymbriopsis*, and subsequent works (e.g., Bondarenko, 1974; Czerepanov, 1995; Ikonnikov, 1979; Junussov, 1978) recognized only these two species. Although *S. mollipila* (Maximowicz) Botschantsev was originally described from Tibet (Maximowicz, 1889), Kuan's (1985) account of the family Cruciferae for the *Flora of Xizang* (Tibet) gave no mention of the species under any genus. By contrast, An (1987) reduced *S. mollipila* to synonymy of *T. mollipila*. He (An, 1991) placed *S. mollipila* in *Neotorularia* Hedge & J. Léonard (= *Torularia* O. E. Schulz (1924), not *Torularia* Bonnemaison (1828) of Rhodophyta) and recognized (An, 1995) some of its variants as members of the genera *Arabidopsis* (DC.) Heynhold and *Microsisymbrium* O. E. Schulz. Léonard (1986) excluded the species from *Neotorularia* and followed Botschantsev (1966) in assigning it to *Sisymbriopsis*.

The important points that need clarification are whether or not *Sisymbriopsis* should be recognized and whether *S. mollipila* should be kept in *Neotorularia*. All species of *Neotorularia* have terete fruits, valves with a prominent or obscure midvein, typically incumbent cotyledons, and nectar glands consisting of lateral ones only. By contrast, all species of *Sisymbriopsis*, including *S. mollipila* and the others herein transferred to this genus, have flattened fruits somewhat rectangular in cross section, prominently 3-veined valves, obliquely accumbent cotyledons, and nectar glands consisting of median nectaries confluent with the lateral ones. In our opinion, these differences are of considerable significance, and they clearly support the recognition of *Sisymbriopsis* as independent from its nearest relative, *Neotorularia*.

Although Botschantsev and Tzvelev (1961) compared *Sisymbriopsis* with *Sisymbrium*, the two genera do not appear to be closely related. The presence in *Sisymbriopsis* of branched trichomes, obliquely accumbent cotyledons, and flattened fruits somewhat rectangular in cross section readily distinguish the genus from *Sisymbrium*, which has simple trichomes, incumbent cotyledons, and terete fruits. Although some of the southern African and South American species of *Sisymbrium* have branched trichomes (Marais, 1970; Romanczuk, 1982; Schulz, 1924), those species are anomalous in the genus and probably ought to be placed in other genera.

As delimited here, *Sisymbriopsis* includes five species, of which one, *S. schugnana*, is endemic to Tajikistan, three are endemic to China, and one occurs in both countries.

Sisymbriopsis Botschantsev & Tzvelev, Not. Syst. Herb. Inst. Bot. Acad. Sci. URSS 21: 143. 1961. TYPE: *Sisymbriopsis schugnana* Botschantsev & Tzvelev.

Herbs annual, biennial, or perennial. Trichomes stalked 1- or 2-forked to dendritic, sometimes

crisped or flattened, rarely exclusively simple. Stems erect to ascending, sometimes decumbent, simple or branched basally and/or apically. Basal leaves petiolate, pinnately lobed to coarsely dentate, rarely subentire. Cauline leaves petiolate or subsessile and not auriculate at base, entire, dentate, to pinnatifid. Inflorescences several-flowered, bracteate or ebracteate corymbose racemes, elongated slightly or considerably in fruit. Sepals oblong, erect, glabrous or pubescent, base of inner pair not saccate, margin membranous. Petals white or lavender, obovate, spatulate, or oblanceolate; claw usually obscurely distinct from blade. Stamens 6, slightly tetradynamous; filaments dilated or not dilated at base; anthers ovate or oblong, sagittate at base, obtuse or apiculate at apex. Nectar glands confluent and subtending bases of all stamens; median nectaries present; lateral nectaries annular. Fruit linear, flattened and latiseptate, appressed to rachis or not, sessile; valves papery, with a prominent midvein and 2 lateral veins and less prominent, anastomosing secondary veins, sparsely to densely pubescent with branched trichomes, rarely glabrescent or with simple hairs, somewhat rectangular in cross section, torulose; septum complete; style obsolete or short and less than 1 mm long; stigma capitate, entire or 2-lobed. Seeds uniseriate, wingless or distally with a small winglike appendage, oblong, slightly flattened; seed coat minutely reticulate, not mucilaginous when wetted; cotyledons obliquely accumbent.

1a. Trichomes simple, flattened; petals 6–10 × 3–5 mm . . . . . 5. *S. yechengnica*
1b. At least some trichomes branched, not flattened; petals 2–4 × 0.6–1.5 mm.
  2a. Fruits secund; fruiting pedicels ascending to divaricate, 5–11 mm long; Tajikistan . . . . . 1. *S. schugnana*
  2b. Fruits not secund; fruiting pedicels erect, appressed to rachis, 0.5–5(–6) mm long; China, Kyrgyzstan, Tajikistan.
    3a. Plants perennial; inflorescence bracteate; anthers not apiculate . . . . . 4. *S. shuanghuica*
    3b. Plants annual; inflorescence ebracteate; anthers apiculate.
      4a. Fruit glabrescent or sparsely pubescent with crisped forked trichomes to 0.4 mm long; stigma subentire to slightly 2-lobed; fruiting pedicel stout; sepals sparsely pubescent with crisped forked trichomes . . . . . 2. *S. mollipila*
      4b. Fruit densely villous with straight forked trichomes to 1 mm; stigma deeply 2-lobed; fruiting pedicels slender; sepals densely villous with straight simple trichomes . . . . . 3. *S. pamirica*

1. Sisymbriopsis schugnana Botschantsev & Tzvelev, Not. Syst. Herb. Inst. Bot. Acad. Sci. URSS 21: 145. 1961. TYPE: Tajikistan. W Pamir, valley Murgab, 5–6 km below fl. W Pschart, ca. 3300 m, 22 June 1958, *N. Tzvelev 256* (holotype, LE; isotype, LE).

Herbs biennial, 8–25 cm tall, densely canescent with a mixture of simple and 1- or 2-forked or subdendritic, short-stalked trichomes. Stems ascending to decumbent, branched primarily from or near base. Basal leaves rosulate, pinnatifid to pinnatisect; petiole (0.5–)1–2(–3) cm long, not ciliate; leaf blade oblong to oblanceolate in outline, (0.5–)1–3.5 cm long, (2–)5–10 mm wide, base cuneate, margin obtusely lobed, the lobes entire or few toothed, apex obtuse to rounded. Middle cauline leaves subsessile to short petiolate, similar to basal leaves but progressively reduced in size upward. Inflorescence ebracteate, rarely lowermost few flowers bracteate, elongated considerably in fruit. Pedicels in fruit ascending to divaricate-ascending, often secund, straight, slender, 3–8(–14) mm long, sparsely pubescent with branched trichomes. Sepals oblong, 2–3 × 1–1.5 mm, scarious at margin, pubescent with branched trichomes. Petals white to pink, spatulate to oblanceolate, 3–4 × 0.5–1.5 mm, attenuate to a clawlike base to 1.5 mm long, apex obtuse. Filaments white to lavender, 2.5–3 mm long; anthers ovate, 0.5–0.6 mm long, apiculate. Fruit (2–)2.5–3.5(–4) cm long, (1.5–)2–2.5 mm wide, divaricate, secund; valves sparsely pubescent with finely branched, crisped forked trichomes, rarely glabrescent; style 0.2–0.8 mm long; stigma subentire to slightly 2-lobed. Seeds yellowish brown, oblong, 1.4–1.8 × 0.7–1 mm, slightly compressed, distal margin sometimes with a minute wing; cotyledons obliquely accumbent. Flowering June–August, fruiting July–September.

Distribution. Endemic to Tajikistan at 3600–4500 m.

Specimens examined. TAJIKISTAN. **Pamir:** Gorno-Badakhshan, Sareszkoe Lake, valley of River Ramanf, 5 km from mouth, *Stanukovych et al. 9743* (LE); Gorno-Badakhshan, River Topolovaya, *Stanukovych et al. 8675* (LE); Gorno-Badakhshan, River Kazankul, 4 km from mouth, *Stanukovych et al. 9422* (LE).

2. Sisymbriopsis mollipila (Maximowicz) Botschantsev, Novit. Syst. Pl. Vasc. 3: 122. 1966. *Sisymbrium mollipilum* Maximowicz, Fl. Tangut. 1: 62. 1889. *Neotorularia mollipila* (Maximowicz) Z. X. An, J. August 1st Agr. Coll. 14(2): 48. 1991. *Stenophragma mollipilum* (Maximowicz) B. Fedtschenko, Rastit. Turkest.

457. 1915. *Torularia mollipila* (Maximowicz) O. E. Schulz, Pflanzenreich IV 105(Heft 86): 217. 1924. TYPE: China. Tibet: Nan Shan, 11–12,000 ft., 23 July 1879, *N. M. Przewalski s.n.* (lectotype, designated by Vassilczenko (1939), LE; isolectotypes, LE, PE).

Arabidopsis qiranica Z. X. An, Fl. Xinjiang. 2(2): 376. 1995. Syn. nov. TYPE: China. Xinjiang: Qira Xian, 3100 m, 22 July 1981, *An Zhengxi 88* (holotype, XJA).

Microsisymbrium taxkorganicum Z. X. An, Fl. Xinjiang. 2(2): 380. 1995. Syn. nov. TYPE: China. Xinjiang: Taxkorgan Xian, 3520 m, 4 July 1978, *Xinjiang Expedition 958* (holotype, WUK).

Herbs annual or rarely biennial, (3–)18–45(–60) cm tall, densely to rarely sparsely covered basally with a mixture of simple and 1- or 2-forked, short-stalked trichomes, sparsely to moderately pubescent apically with crisped forked trichomes or rarely glabrescent. Stems erect, simple or sometimes branched at base. Basal leaves withered by fruiting time; petiole (0.5–)1–1.7(–3) cm long, strongly flattened at base, ciliate with simple trichomes to 1.5 mm long; leaf blade narrowly oblong to linear-lanceolate, (1–)2–4(–7) cm long, 2–8(–12) mm wide, base cuneate, margin coarsely dentate to pinnatifid, apex acuminate. Middle cauline leaves subsessile to short petiolate, linear to linear-lanceolate, 1.5–5(–8) cm long, 1–5(–10) mm wide, progressively reduced in size upward, margin entire to dentate, apex acuminate. Inflorescence ebracteate, elongated considerably in fruit. Pedicels in fruit erect, appressed to rachis, straight, stout, (0.5–)1–3(–4) mm long, sparsely pubescent with crisped, branched trichomes. Sepals oblong, (1.5–)2–2.5 × 0.8–1 mm, scarious at margin, sparsely pubescent with crisped branched trichomes. Petals white to lavender, oblanceolate, (2–)2.5–4 × (0.6–)0.9–1.2(–1.5) mm, attenuate to a clawlike base to 1.5 mm long, apex obtuse. Filaments white to lavender, (1.5–)2–3 mm long; anthers oblong to subovate, (0.3–)0.4–0.6 mm long, apiculate. Fruit (1.5–)3–5(–7) cm long, 1–1.2 mm wide, erect, appressed to rachis; valves sparsely pubescent with finely branched, crisped forked trichomes to 0.4 mm long, rarely glabrescent; style obsolete to 0.6 mm long; stigma subentire to slightly 2-lobed. Seeds yellowish brown, oblong, 0.9–1.4 × 0.6–1 mm, slightly compressed, distal margin sometimes with a minute wing; cotyledons obliquely accumbent. Flowering June–August, fruiting July–September.

Distribution and habitat. Afghanistan, China (Qinghai, Xinjiang, Xizang), Kyrgyzstan, Tajikistan. Exposed banks, gravelly steep slopes, flood land, alluvial plains, sandy or gravelly beaches, mountain valleys, grassy slopes, *Juniperus* woods; 2900–4500 m.

Sisymbriopsis mollipila is reported here for the first time from Afghanistan. It has been collected extensively from Kyrgyzstan and Tajikistan, but only a few representative samples are cited from these two countries. It is the most widespread and variable species of the genus. Leaf size and margin, fruit length, and density of the indumentum on the upper parts, especially the fruit valve, are the most variable characters. However, the variation in these characters is continuous and can be found within the same population.

The types of *Arabidopsis qiranica* and *Microsisymbrium taxkorganicum* are short-fruited forms of *Sisymbriopsis mollipila*, with the former being glabrescent whereas the latter is moderately pubescent. Other features of both types are basically a perfect match with plants of *S. mollipila*.

Sisymbriopsis mollipila is most closely related to *S. pamirica*. Both species have erect fruits appressed to the rachis, small flowers to 4 mm long, and short pedicels rarely reaching 4 mm in length. However, they can be readily distinguished by their pedicels, stigmas, sepals, and type of trichomes on the fruit valves. *Sisymbriopsis mollipila* has stout pedicels, subentire to slightly 2-lobed stigmas, sepals and fruit valves sparsely pubescent with crisped, forked trichomes to 0.4 mm long, whereas *S. pamirica* has slender fruiting pedicels, deeply 2-lobed stigmas, sepals with straight simple trichomes, and fruit valves densely pubescent with straight, forked trichomes to 1 mm long.

Specimens examined. AFGHANISTAN. **Badakhshan:** Wakhan, NW Kol-e-Chaqmaqtin, *Anders 7567* (M). CHINA. **Qinghai:** Qagan Us river, *C. Y. Wu, S. K. Chen, Du Qing & S. L. Lu 75-207* (HNWP); Delingha, Baishu Shan, *B. Z. Guo & W. Y. Wang 11616* (HNWP); upper reach of Nomhon He, *Du Qing 340* (HNWP); Qaidam, Dangshe Shan, *Qinghai-Gansu Expedition 584* (PE), *Qinghai-Gansu Expedition 602* (PE); Qaidam, Xilqou, *Qinghai-Gansu Expedition 641* (PE); Qaidam, Dulan, *Qinghai-Gansu Expedition 1681* (PE). **Xinjiang:** Yecheng Xian, *Qinghai-Xizang Expedition 870863* (KUN), *Y. H. Wu 1017* (HNWP); Ruoqiang Xian, Piaqiriketagor, *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei 2152* (KUN, TI); Ruoqiang, N slope of Qimantag Mt., *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei 2686* (TI); Qira, Nur, *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei 1986* (KUN, MO, TI); Qira Xian, Nur, Yamei, *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei 2530* (KUN, MO, TI); Yuitian Xian, Pulu Kanyan, *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei 3779* (TI); Yutian Xian, Pulu Sanchakou, *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei 3790* (HNWP, KUN, TI); Pishan Xian, Kaxtax Ruoqiang, *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei 3646* (HNWP, MO, TI), *Y. H. Wu 3647* (HNWP); Taxkorgan Xian, *B. S. Li, E. Zheng & B. P. Zhang 10496* (PE), *G. L. Zhou* (MO); Taxkorgan Xian, Hongqilapu, *S. G. Wu, Y. H. Wu & Y. Fei 4872* (KUN, TI); 106 km S of Taxkorgan, *Kilim T-74* (XJA,

XJBI). **Xizang (Tibet):** Burchan Budda, 14 Apr. 1884, *Przewalski s.n.* (LE, P). KYRGYZSTAN. Semirechenskaya Range, River Aksay, 25 July 1903, *Lipsky s.n.* (LE); Narinsky Range, basin of River Aksay, *Sovetkina & Uspenskaya 1796* (LE); Prezwalski, River Kujandi, 30 July 1913, *Schischkin s.n.* (LE); Tian Shan, bank of River Ichiktor, 27 July 1960, *Kozshevnikova s.n.* (LE). TAJIKISTAN. Pamir & Tian Shan, 1906, *Appelton s.n.* (K); near Bordaba, *Alexeenko 2059* (LE).

3. Sisymbriopsis pamirica (Y. C. Lan & Z. X. An) Al-Shehbaz, Z. X. An & G. Yang, comb. nov. Basionym: *Arabis pamirica* Y. C. Lan & Z. X. An, Fl. Xinjiang. 2(2): 375. 1995. TYPE: China. Xinjiang: Taxkorgan Xian, 3700 m, 5 July 1978, *Xinjiang Expedition 1031* (holotype, WUK).

Herbs annual or? perennial, ca. 30 cm tall, densely villous throughout with straight, 1-forked, stalked and simple trichomes. Stems erect, branched at base and above. Basal leaves unknown; lower and middle cauline leaves short petiolate, lanceolate to oblong-lanceolate, 1–3 cm long, 4–10 mm wide, base cuneate, margin coarsely dentate to pinnatifid, apex acuminate. Inflorescence ebracteate, elongated considerably in fruit. Pedicels in fruit erect, appressed to rachis, straight, slender, 2–4 mm long, densely covered with simple and branched trichomes. Sepals oblong, 1.5–2 × ca. 0.5 mm, scarious at margin, densely pubescent with straight simple trichomes. Petals lavender, oblanceolate, 2–2.5 × ca. 0.7 mm, attenuate to base, apex obtuse. Filaments lavender, 1.2–2 mm long; anthers suboblong, ca. 0.5 mm long, minutely apiculate. Fruit 3–4.7 cm long, 1–1.1 mm wide, erect, appressed to rachis; valves densely villous with straight, stalked, forked trichomes to 1 mm long; style obsolete; stigma deeply 2-lobed. Seeds yellowish brown, oblong, 0.8–1 × 0.6–0.7 mm, slightly compressed; cotyledons obliquely accumbent. Flowering and fruiting July.

Distribution. Endemic to Xinjiang (China) and known only from the type, which was collected at ca. 3700 m.

The original description of *Arabis pamirica* (An, 1995) indicated that the type was collected in August rather than July, contrary to what the holotype label shows.

4. Sisymbriopsis shuanghuica (Kuan & Z. X. An) Al-Shehbaz, Z. X. An & G. Yang, comb. nov. Basionym: *Torularia shuanghuica* Kuan & Z. X. An, Fl. Xizang. 2: 404. 1985. TYPE: China. Xizang (Tibet): Shuanghu, 4950 m, 29 July 1976, *Lang Kai-yong 9891* (holotype, PE; isotypes, HNWP, KUN, PE).

Herbs perennial with a slender, simple or branched caudex, (5–)18–45(–60) cm tall, canescent, densely tomentose throughout with short-stalked, dendritic and fewer 2-forked trichomes. Stems erect to subdecumbent, branched basally and above. Basal leaves not rosulate; petiole 5–10 mm long, not flattened, ciliate at base; leaf blade spatulate to oblanceolate, 0.5–2 cm long, 1.5–5 mm wide, base cuneate, margin coarsely dentate to repand or entire, apex obtuse to subacute. Middle cauline leaves subsessile to short petiolate, similar to basal ones but progressively smaller upward. Inflorescence bracteate at least along lower half, elongated slightly in fruit. Pedicels in fruit erect, appressed to rachis, straight, slender, 3–5(–6) mm long, densely tomentose as rest of plant. Sepals oblong, 2–2.5 × ca. 1 mm, scarious at margin, densely pubescent. Petals white to lavender, spatulate, 2.5–3.5 × 0.9–1.5 mm, attenuate to a clawlike base to 1 mm long, apex obtuse. Filaments lavender, 2–3 mm long; anthers subovate, 0.4–0.5 mm long, not apiculate. Fruit 1.5–3 cm long, 1–1.3 mm wide, erect, appressed to rachis; valves densely pubescent with finely branched, short-stalked dendritic trichomes to 0.5 mm long; style to 0.5 mm long; stigma subentire to slightly 2-lobed. Seeds yellowish brown, oblong, 0.8–1 × 0.5–0.7 mm, slightly compressed; cotyledons obliquely accumbent. Flowering and fruiting July.

Distribution and habitat. Endemic to Xizang, China. Mountain slopes, sandy areas; 4800–4900 m.

Because of the limited collections available for this study, little can be said about the variability of *Sisymbriopsis shuanghuica.* This species and *S. mollipila* were placed in *Neotorularia* by An (1991), but the presence in both species of typically flattened fruits, strongly 3-veined valves, obliquely accumbent cotyledons, and median nectaries clearly support their placement in *Sisymbriopsis. Sisymbriopsis shuanghuica* differs from the remaining species of the genus on account of its perennial habit and bracteate inflorescences. However, these two characters alone do not carry much weight in the delimitation of genera in the family.

Two sheets at PE were marked as the type of *Sisymbriopsis shuanghuica.* The one carrying the PE number 1172825, which is the more complete, is taken here as the holotype, and that numbered 1172826 is annotated as the isotype.

Specimens examined. CHINA. **Xizang (Tibet):** Shuanghu, 4800 m, *Anonymous 11990* (PE).

5. Sisymbriopsis yechengnica (Z. X. An) Al-Shehbaz, Z. X. An & G. Yang, comb. nov. Basionym: *Microsisymbrium yechengnicum* Z. X. An, Bull. Bot. Res. North-East Forest. Inst. 1(1–2): 99. 1981. TYPE: China. Xinjiang: Yecheng Xian, Kunlun Shan, 1 July 1974, 3000 m, *Anonymous 3347* (holotype, HNWP; isotype, PE).

Herbs annual or perennial, 15–50 cm tall, glabrescent to sparsely pubescent with flattened, crisped, simple trichomes to 0.7 mm long. Stems erect to subdecumbent, simple or many-branched at base. Basal leaves withered by fruiting time, not rosulate; petiole 0.5–3 cm long, not flattened at base; leaf blade narrowly oblong to linear-lanceolate, 2–4 cm long, 1–5 mm wide, base cuneate, margin coarsely dentate to pinnatifid and lobes to 5 × 1 mm, rarely subentire, apex acuminate. Middle cauline leaves subsessile to petiolate, similar to basal leaves but progressively reduced in size upward, 3–7 cm × 2–6 mm, margin entire to dentate, apex acuminate. Inflorescence ebracteate, elongated considerably in fruit. Pedicels in fruit divaricate to ascending, recurved to straight, slender, 0.7–1.8(–2.5) cm long, glabrescent or sparsely pubescent with crisped, simple trichomes. Sepals oblong, 3–4 × 1.5–2 mm, scarious at margin, glabrous. Petals white to lavender, obovate, 6–10 × 3–5 mm, cuneate to a claw 1–2 mm, apex obtuse. Filaments white, 2.5–3.5 mm; anthers narrowly oblong, 0.9–1.1 mm long, not apiculate. Fruit (1.5–)2.5–4 cm long, 1–1.2 mm wide, spreading; valves glabrescent, rarely sparsely pubescent with crisped simple trichomes to 0.5 mm long; style 0.4–0.6(–0.9) mm long; stigma entire. Seeds yellowish brown, oblong, 1.2–1.7 × 0.8–1 mm, slightly compressed, distal margin with a minute wing; cotyledons obliquely accumbent. Flowering June–July, fruiting July–August.

Distribution and habitat. Endemic to Xinjiang, China. Grasslands, mountain slopes, sandy areas, steep rocky river banks; 2500–3000 m.

Two collections, *Wu et al. 1842* and *2410*, differ from the type collection and other examined specimens in being coarse perennials and many-branched at base (instead of smaller annuals and unbranched at base). Both collections do not have fully mature fruits, and they might represent an independent infraspecific taxon of *Sisymbriopsis yechengnica*. However, in their leaves, flowers, trichomes, and pedicel morphology they are indistinguishable from typical plants of the species.

Sisymbriopsis yechengnica is readily distinguished from the other species of the genus by its simple, flattened, crisped trichomes and large petals 6–10 × 3–5 mm. All other species of *Sisymbriopsis* have branched trichomes and petals 2–4 × 0.6–1.5 mm. However, in all other characters, especially fruits, nectar glands, foliage, and cotyledonary position, *S. yechengnica* is perfectly at home in *Sisymbriopsis*.

Specimens examined. CHINA. **Xinjiang:** Pishan, Buqun, *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei 1842* (KUN, MO, TI); Pishan Xian, Naoarbati, *S. G. Wu, H. Ohba, Y. H. Wu & Y. Fei 2410* (HNWP, KUN, MO, TI); 10 km N of Kalmakkuouk on Xinjiang–Xizang Hwy., *Anonymous 523* (KUN, PE); Yecheng Xian, *Qinghai-Xizang Expedition 870754* (KUN).

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A New Species of *Ruprechtia* (Polygonaceae) from the Venezuelan Guayana

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ABSTRACT. *Ruprechtia howardiana*, from deciduous forests in Bolívar state, Venezuela, is newly described and illustrated. It appears most closely related to *R. ramiflora* (Jacquin) Meyer.

Ruprechtia is a genus of small trees or shrubs from neotropical dry and riverine forests. The genus has been closely allied with *Triplaris*, but differs in its 2- or 3-flowered pistillate partial inflorescences, a basal pedicel-like extension of the perianth tube in fruit, and pedicellate male flowers with perianth segments connate for less than a third of their length (Brandbyge & Øllgaard, 1984; Brandbyge, 1986). It also typically has fewer pairs of secondary leaf veins (less than 12) than *Triplaris*, smaller leaves, and achenes loosely enclosed within the fruiting perianth.

The species described below was treated by Howard (1985: 507) as an "unplaced collection," a probable new species for which he wanted additional specimens before describing. Although it is still known only from staminate material, the specimens are distinct enough from other members of the genus for us to describe it at this time, making it available for inclusion in the upcoming Polygonaceae treatment for the *Flora of the Venezuelan Guayana*.

Ruprechtia howardiana Aymard & P. E. Berry, sp. nov. TYPE: Venezuela. Bolívar: middle Río Orinoco, Cerro Baraguán and vicinity, dry forest, 100–330 m, 13 Jan. 1956, *Wurdack & Monachino 41230* (holotype, VEN; isotypes, HB, MO, NY, US). Figure 1.

Species nova quae *R. ramiflorae* (Jacquin) Meyer affinis sed ab ea foliis subtus inflorescentiaque dense hirsutis, costa supra depressa atque sepalis ovatis usque obovatis differt.

Dioecious tree ca. 3 m tall; twigs with solid internodes. Branchlets densely pubescent, becoming glabrescent when mature, lenticellate; leafy internodes 1.5–3(–4) cm long. Leaves simple, alternate, ovate, chartaceous, 7–16 × 4–8 cm, the base acute or slightly unequal, the apex acuminate, margins subrevolute, the midrib depressed above, glabrous on the upper surface except the midrib and secondary nerves covered by a gray appressed pubescence, brownish hirsute on the lower surface, more densely so on the midrib and secondary nerves; lateral nerves 10–15 on each side, tertiary venation conspicuous on both sides; petioles 4–6 mm long, densely yellow pubescent; stipules forming a short (1 mm) tube around the stem and leaving a ring around the stem. Inflorescence axillary racemes or dense clusters of racemes 2–9 cm long; pedicels 1.5–3 mm long, sparsely appressed pubescent to glabrous; staminate flowers white, sepals 3, ovate to obovate, 1–2 mm long, membranaceous, glabrous on both sides, ciliate at the margins; petals 3, similar to the sepals and alternate with them; stamens 7–9, filaments glabrous, 2–3 mm long; anthers glabrous, ca. 0.8 mm long; oblong, pistillode absent; pistillate flowers and fruit not seen.

Ruprechtia howardiana is most closely allied to *R. ramiflora* from Venezuela, Colombia, Guyana, and Brazil but differs in its inflorescence and lower surface of the leaves densely hirsute, the midrib impressed on the upper surface, and the sepals ovate to obovate. *Ruprechtia ramiflora* occurs in a wide variety of habitat types but has glabrous to sparsely pubescent leaves and inflorescences, the midrib elevated on the upper leaf surface, and the sepals spathulate.

This species is named after Richard Alden Howard (1917–) for his previous work on *Triplaris*, *Coccoloba*, and other members of the Polygonaceae.

Acknowledgments. We are grateful to Roy Ger-

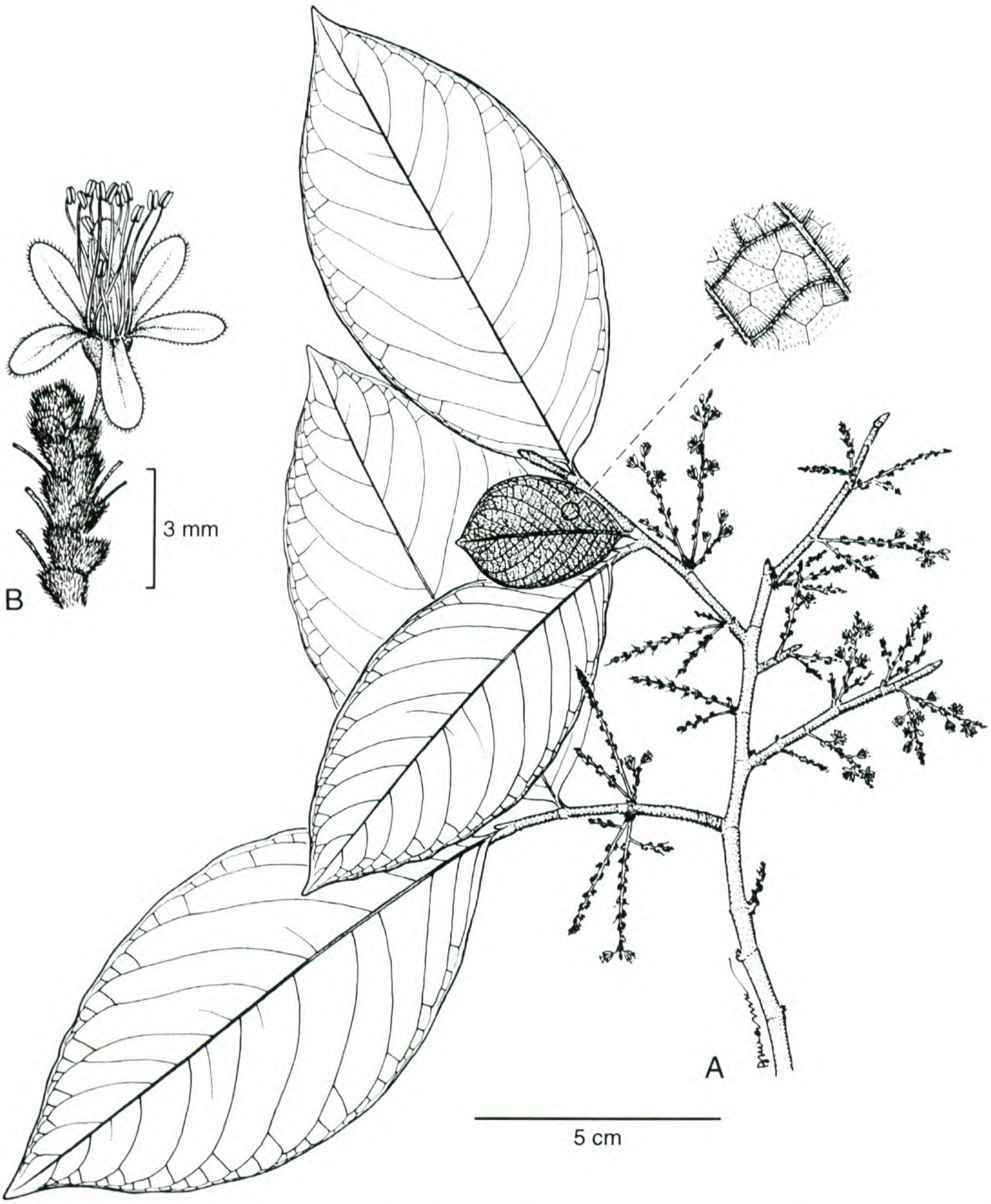

Figure 1. *Ruprechtia howardiana* Aymard & P. E. Berry. —A. Flowering branch. —B. Detail of male flower. Based on *Wurdack & Monachino 41230.*

eau for revising the Latin diagnosis and to Bruno Manara for preparing the illustration.

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Rudgea tayloriae (Rubiaceae), an Unusual New Species from the Eastern Slopes of the Venezuelan Andes

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ABSTRACT. *Rudgea tayloriae* (Rubiaceae), a new species from the eastern slopes of the Venezuelan Andes, is described and illustrated, and its relationships are discussed.

Rudgea Salisbury is a neotropical genus of ca. 150–170 species (Dwyer, 1980; Taylor et al., 1991; Taylor, 1996), most of which are South American. Andersson's (1992) checklist of neotropical Rubiaceae included 214 species names, but his objective in compiling the list was not to make taxonomic decisions, and a number of the names he cited are clearly synonyms. Steyermark (1974) recognized 28 species of *Rudgea* in his treatment of the Venezuelan Rubiaceae. Subsequently, Steyermark (1981, 1988) described an additional four species of *Rudgea* from Venezuela.

The valvate corolla lobes, 2-celled ovary, and fleshy drupe with two pyrenes place *Rudgea* in the subfamily *Rubioideae* tribe *Psychotrieae* A. Richard ex Dumortier (Robbrecht, 1988; Taylor, 1996). *Rudgea* is similar to *Palicourea* Aublet and *Psychotria* L., but it usually can be separated from these closely related genera by the pectinate or fimbriate appendages on its stipules (Steyermark, 1974; Standley & Williams, 1975; Dwyer, 1980; Taylor, 1996). This stipule character, however, can present practical problems in identifying material since the stipules frequently are caducous, as has been noted earlier by Taylor et al. (1991).

Rudgea tayloriae Aymard, Dorr & Cuello, sp. nov. TYPE: Venezuela. Trujillo: Dtto. Boconó, Parque Nacional Guaramacal, selvas nubladas de la vertiente sur, aprox. 9°12′45″N, 70°09′51″W, 2300 m, 3–5 Jan. 1996 (fl, fr), *N. Cuello, R. González, C. Oráa & A. González 1350* (holotype, PORT; isotypes, MO, US, VEN). Figure 1.

Species nova quae a *Rudgea hospe* Standley & Steyermark floribus sessilibus, corollis purpureis, tubo 3–4 mm longo, lobis 1–1.5 mm longis, filamentis ca. 1 mm longis, papillatis, basi tubi affixis, antheris ca. 2.5–3 mm longis, stigmate furcato differt.

Small trees to 8 m tall, branches and branchlets glabrous throughout. Leaves opposite, decussate; blades elliptic to ovate-elliptic, 5–11 cm long, 2.5–7 cm wide, acuminate at apex with the tip up to 2–2.3 mm long, acute at base, margin entire, glabrous and well reticulated on upper surface, glabrous underneath, except along the midrib and lateral nerves, which are sparsely appressed-pubescent to puberulent when mature, lateral nerves 7–10 pairs, convergent and linking toward margin; petioles 5–13 mm long, ca. 1 mm thick, subcanaliculate, sparsely appressed-pubescent at first, glabrous when mature. Stipules interpetiolar, ciliate, caducous, briefly persistent only on uppermost 1–2 nodes, united around the stem into a cupuliform structure, 1.5–4 mm long, rounded to truncate apically, sparsely appressed-pubescent at first, glabrous when mature, with 6–8 projections ca. 1 mm long. Inflorescences terminal, spiciform to subcapitate, 1.5–2.5 cm long (or unexpanded?), appressed-pubescent with white trichomes; bracts subtending the flowers subulate, 4–8 mm long, apex with the tip 0.5–2 mm long, shortly appressed-pubescent externally, glabrous internally. Flowers sessile, calyx ca. 2 mm long, cupuliform, puberulent to densely appressed-pubescent at the base exter-

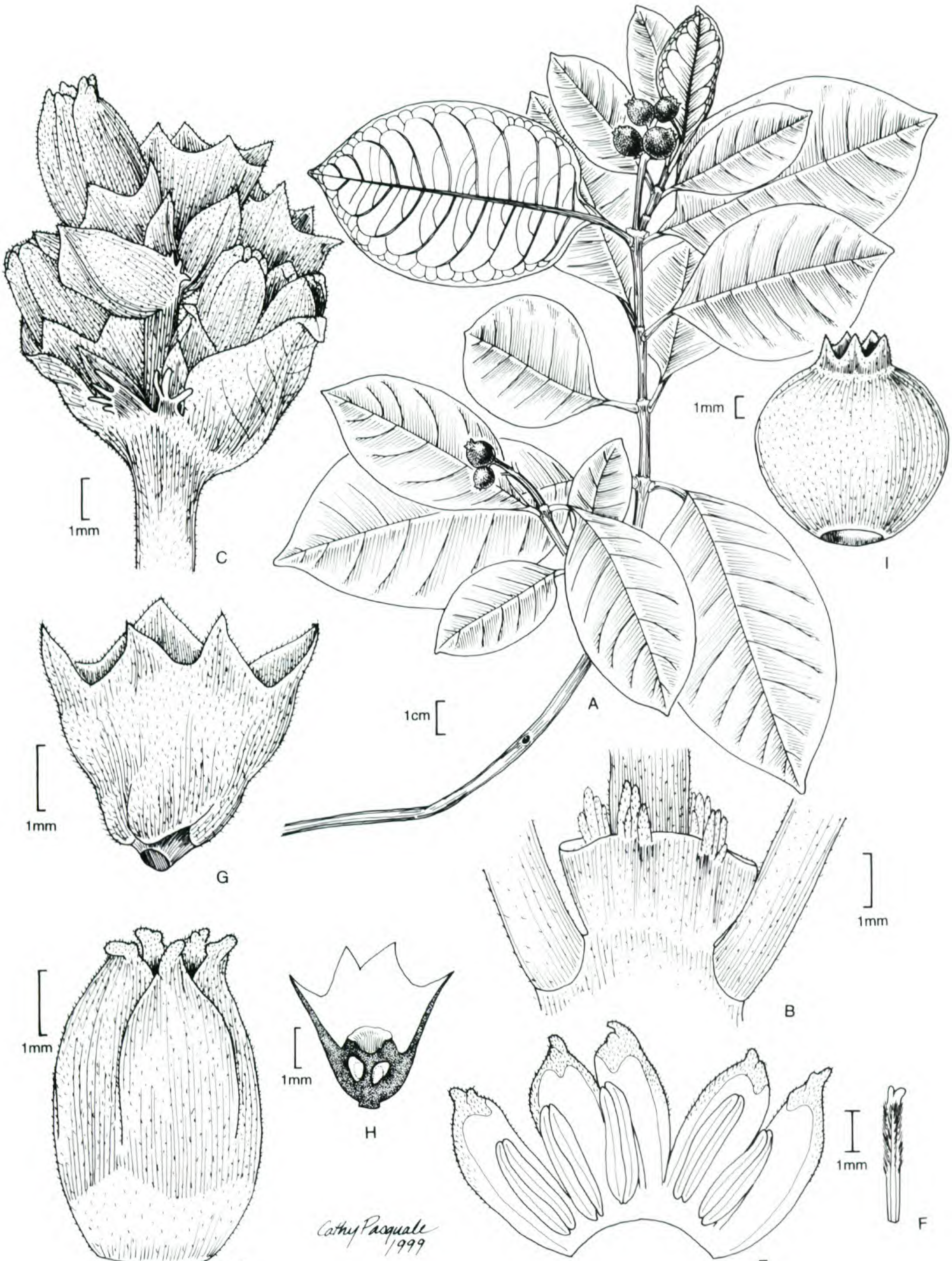

Figure 1. *Rudgea tayloriae* Aymard, Dorr & Cuello. —A. Habit. —B. Stipule. —C. Inflorescence (immature). —D. Corolla (immature). —E. Corolla, opened to show anthers (immature). —F. Style and stigma. —G. Calyx. —H. Longitudinal section through calyx and hypanthium. —I. Fruit. A, C–I drawn from *Cuello et al. 1350* (PORT) and B from *Cuello et al. 1310* (US).

nally, puberulent internally, 5-lobed, the lobes ca. 0.5 mm long, triangular, persistent in fruit; corolla purple, evidently funnelform, but shortly rounded or constricted at the apex (mature flowers not seen), the tube 3–4 mm long, short appressed-pubescent to puberulent externally, glabrous internally, 5-lobed, the lobes 1–1.5 mm long, pubescent as the tube; stamens 5, inserted at the base of the tube (in immature flowers?), filaments ca. 1 mm long, glabrous, papillate, anthers 2.5–3 mm long, oblong, glabrous; style ca. 2 mm long, barbate apically, stigma bifurcated, barbate basally, 1 mm long. Fruit ovoid, black, 9–10 mm long, 6–7 mm wide, sparsely pilose to glabrous when mature, subtended by one bract.

Distribution and habitat. *Rudgea tayloriae* is known only from the type locality on the eastern slopes of the Andes in Trujillo state, Venezuela, where it has been collected in moist cloud forest from 1950 to 2300 m. Flowers and fruit are known only from January.

Rudgea tayloriae appears to be most similar to *R. hospes* Standley & Steyermark, which also is endemic to the Venezuelan Andes. The lateral branches of the inflorescences of both species are not developed, and the lateral nerves on the upper leaf surfaces are convergent and linking toward the leaf margins. *Rudgea tayloriae* differs from *R. hospes* in having sessile (vs. shortly pedicellate with pedicels 1–2.5 mm long) flowers, purple (vs. white) corollas, smaller (3–4 mm vs. ca. 7 mm long) corolla tubes, smaller (1–1.5 mm vs. ca. 5.5 mm long) corolla lobes, shorter (ca. 1 mm vs. 2.8–3 mm long) filaments, and shorter (2.5–3 mm vs. ca. 5 mm long) anthers. Also, the filaments of *R. tayloriae* are papillate (vs. smooth), evidently inserted at the base (vs. middle) of the corolla tube, and the stigmas are bifid (vs. undivided).

The appendages on the corolla lobes of *Rudgea tayloriae* are distinctive and further serve to distinguish this new species from *R. hospes*, which lacks appendages on the corolla lobes. The purple corollas of *R. tayloriae* are remarkable in that the majority of species in the genus seem to have white corollas. In addition, the black fruits are unusual in the genus, which usually has white fruits at maturity (Taylor, 1996).

We take pleasure in naming this new species after Charlotte M. Taylor (b. 1955), who initially drew the attention of the first author to its distinctive characters, and who has made significant contributions to our knowledge of neotropical Rubiaceae.

Paratypes. VENEZUELA. **Trujillo:** Dtto. Boconó, Parque Nacional Guaramacal, selvas nubladas de la vertiente sur, 9°12′28″N, 70°09′41″W, 1950 m, 19–22 Dec. 1995 (st), *Cuello et al. 1310* (PORT, US), *1312* (MO, PORT, US), aprox. 9°12′45″N, 70°09′51″W, 2300 m, 3–5 Jan. 1996 (st), *Cuello et al. 1331* (MO, PORT, US), aprox. 9°13′N, 70°07′W, 2100 m, 20–22 Dec. 1996 (st), *Licata et al. 673* (PORT, US).

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Cirsium ochrocentrum subsp. *martinii* (Asteraceae), a New Subspecies of the Santa Fe Thistle from the Gila River Region of Arizona and New Mexico

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ABSTRACT. A morphological study of *Cirsium ochrocentrum* supports separation of the phenotype with red corollas of the upper Gila River drainage from typical materials with purple or white corollas from surrounding regions. This taxon shows intergradation and overlap of character distributions with typical populations and is recognized as a subspecies. *Cirsium ochrocentrum* subsp. *martinii* differs from the typical variety by its red corolla color, short style tips and spines, and generally shorter decurrence.

The American thistle genus *Cirsium*, with over 140 species (Ownbey et al., 1975), is an important part of the North American flora. Although American thistles have been falsely maligned as aggressive weeds because of their Eurasian congeners (Lamp & McCarty, 1981), western thistles provide a vital, and sometimes obligate, food source for many animal species including goldfinches, hummingbirds, and crescent butterflies (Martin et al., 1951; Tilden & Smith, 1986). Despite the ecological importance of these plants, taxonomists have largely neglected thistles. Current thistle taxonomy has both a confusing number of synonyms and a multitude of undescribed phenotypes that merit taxonomic recognition. In this report, I describe one such unrecognized group.

Ownbey and Hsi (1963) suggested that the red-corolla phenotype of the Santa Fe Thistle, *Cirsium ochrocentrum*, might warrant recognition at the subspecies or species level. Hsi (1960) proposed a new taxon based on materials from Arizona with red corollas but did not validate the name with a published description. Barlow (1992) studied variation within the *C. ochrocentrum* group and showed that the red-flowered phenotype, which is found in the Gila River drainage of southeastern Arizona and southwestern New Mexico, was separable from the normally purple-flowered populations of the Rio Grande, Great Plains, Trans-Pecos, and Colorado Plateau. A summary of that analysis and the resulting description is presented here.

Methods and Materials

Twelve morphological characters were measured on field-collected specimens from 56 populations (Fig. 1). Voucher specimens are deposited at UNM. The morphological characters used in this analysis were terminal leaf spine length, decurrence length, leaf length, corolla tube length, corolla throat length, corolla lobe length, style tip length, anther appendage tip length, anther appendage body length, pappus length, phyllary length, and phyllary spine length. Each population was represented by 1 to 18 specimens, and each floral character was represented by the average of 10 measurements per plant. This data set and the characters are fully described in Barlow (1992).

A canonical discriminant analysis (CDA), using population averages, was used to graphically portray the distinctiveness of the red-corolla populations of the Gila River drainage from the typical Rio Grande valley purple-corolla populations. A third group, consisting of specimens from geographically intermediate populations with intermediate colors, was included to both verify their intermediacy in other character states and to offset the polarization of a CDA with only two taxa. Individuals were assigned to one of these three groups for this analysis. Discriminant analysis gives a linear combination of characters that best describes the classification. Ninety-five percent probability ellipses for the variance of each population were calculated. In a second analysis, 65 purple-corolla specimens from the upper Rio Grande Valley near the type locality of the typical subspecies were compared with 49 red-flowered specimens from Catron County, New Mexico, in a Kruskal-Wallis non-parametric comparison of the means. Statistical analysis was performed with NPAR1WAY, CANDISC, and IML procedures of the Statistical Analysis System (SAS Institute, 1989). Two hundred twelve herbarium specimens of *Cirsium ochrocentrum* were examined.

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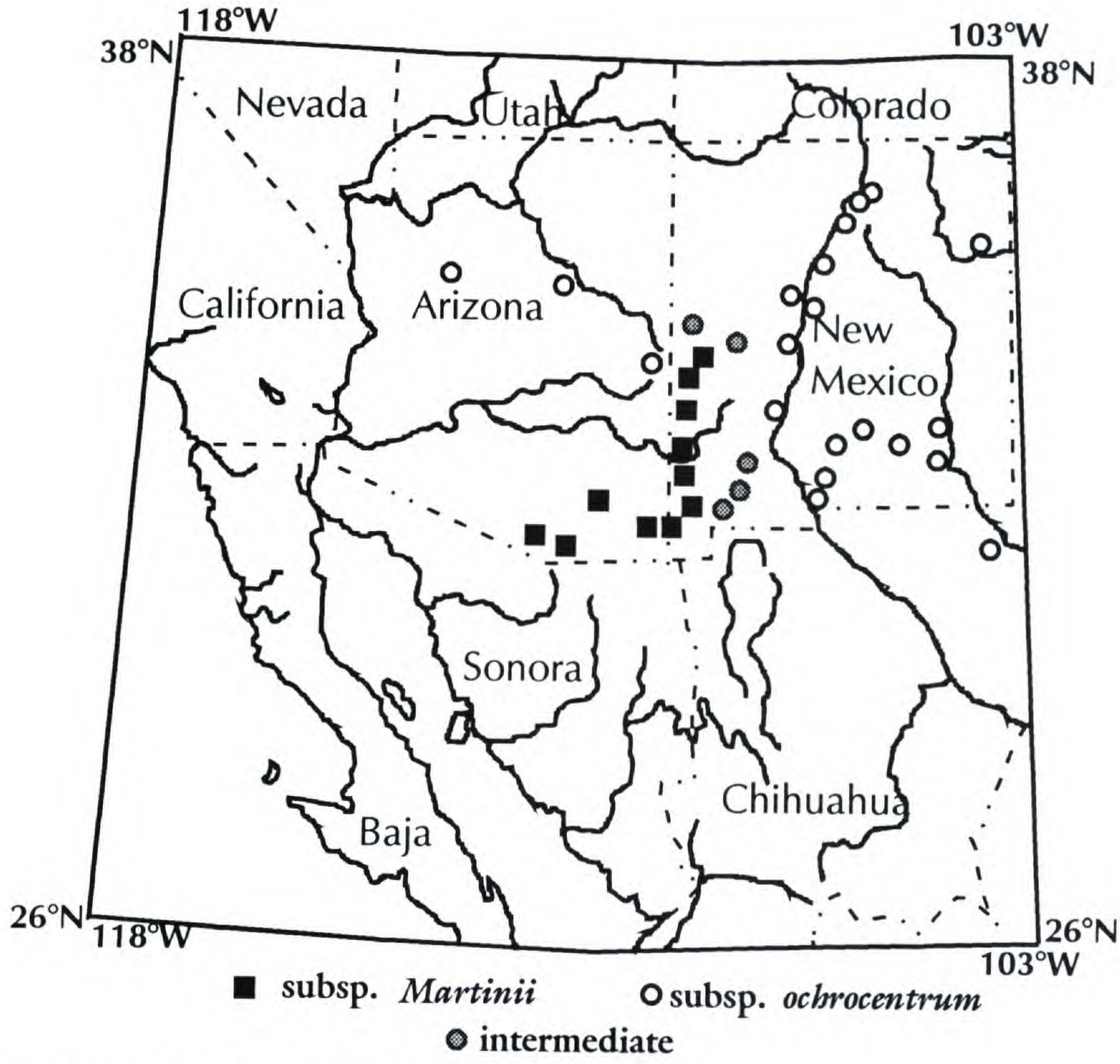

Figure 1. Distribution of populations under study.

Results

The CDA procedure separated the red (Gila) and purple (Rio Grande) phenotypes except for a small intersection (Fig. 2). These two color phenotypes separated along the first canonical axis, with the geographical intermediates placed near their intersection. The canonical correlations of the first axis are highly significant at $P < 0.0001$, while those of the second axis are not significant (Table 1).

The first canonical axis explains 92.7% of the total variance between phenotypes. This axis contains a linear combination of all quantitative characters with length of both anther appendage variables, phyllary spine length, and style tip length being the most prominent factors (Table 2). The Kruskal-Wallis comparison of means for the Gila and Rio Grande phenotypes results in significant differences in 10 characters although there is extensive overlap in the distribution of characters (Table 3). Pappus length and phyllary length are not significantly different between these phenotypes.

Discussion

These analyses support the recognition of *Cirsium ochrocentrum* subsp. *martinii* by showing that using quantitative morphological characters alone, the two taxa can be separated with very little overlap when geographically intermediate populations are excluded. The small degree of overlap between the taxa, despite the power of CDA to divide groups, indicates that they are not divided by any discontinuous character distributions, as evidenced in Table 3. Although these taxa have different corolla colors and morphological features, they apparently intergrade in the intermediate populations along the narrow zone of contact between their geographical ranges. Some authors might rank these two taxa as separate species; however, a conservative approach, ranking them as subspecies, better reflects the close relationship and high degree of morphological similarity, relative to more differentiated congeners. The subspecific rank denotes morphologically distinguishable, geographically separate groups within species (Davis, 1978).

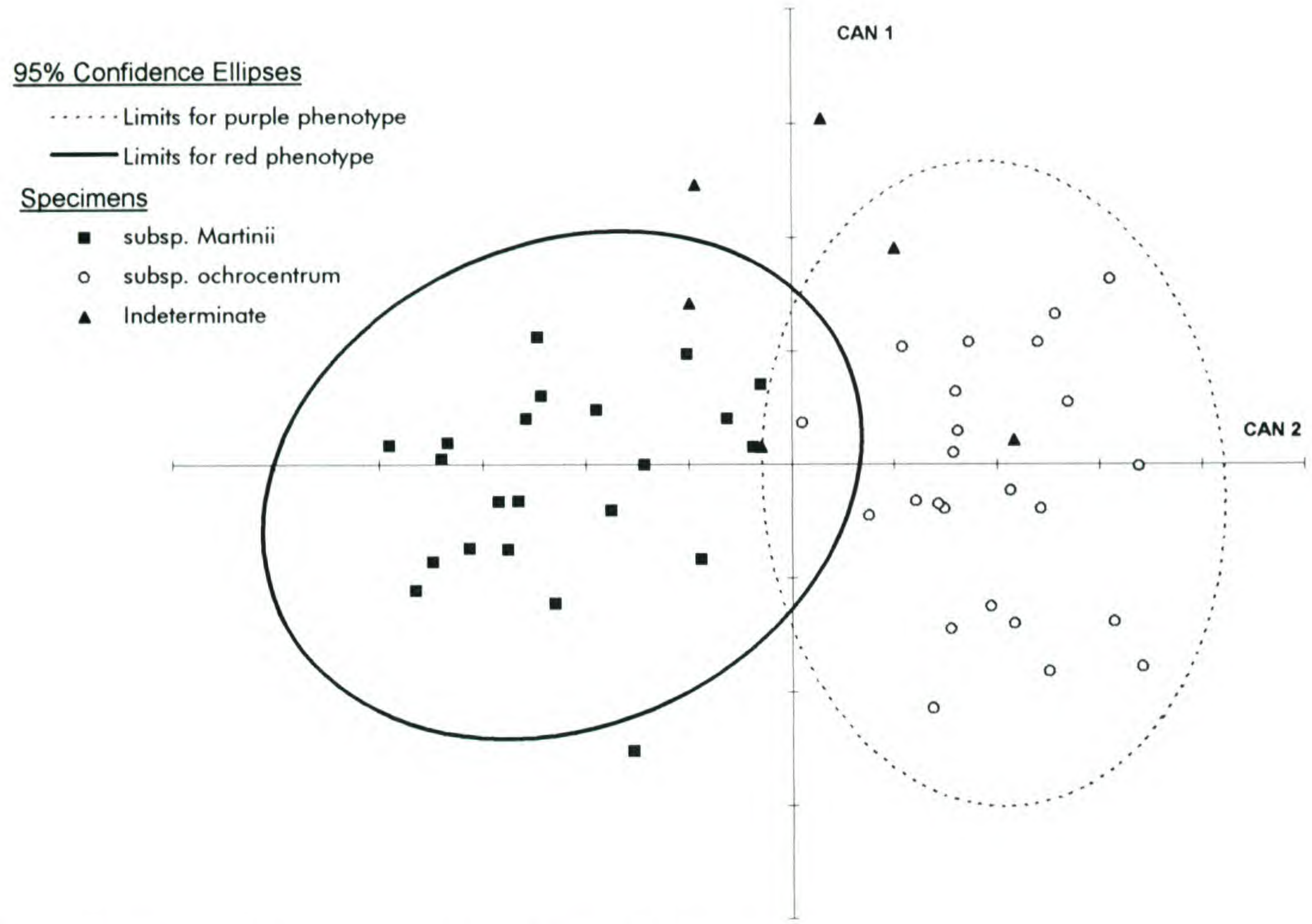

Figure 2. Canonical discrimination and group 95% probability intervals.

Cirsium ochrocentrum A. Gray subsp. **martinii** P. Barlow, subsp. nov. TYPE: U.S.A. New Mexico: Catron County, T8S, R18W sec. 10, 108.203°W, 33.768°N, 5800 ft. elev., 5 mi. E of the San Francisco River bridge at Reserve, New Mexico, along N.M. Highway 12, 28 July 1997; *Barlow 97-8* (holotype, US; isotypes, ASU, MO, NMC, UNM).

Subspecies haec a subspecie typica differt corollis puniceis, styli apice supra nodum breviore (saepe minus quam 5 mm longo), et antherarum appendicum corporibus plerumque plus quam 2 mm longis (1.5–2.8 mm).

Perennial caulescent herbs to 90 cm. Stems moderately branched, striate-ribbed with a dense, lanate covering of white appressed hairs. Leaves lanceolate, ascending or sometimes deflexed in age; basal leaves much larger than upper leaves. Leaf surface densely white tomentose on abaxial side; adaxial surface loosely arachnoid. Cauline leaves mostly less than 10 mm in decurrence; basal leaves not decurrent, petiolate. Leaf blades pinnatifid shallowly or nearly to the midrib; pinnae cleft into 4 or 5 angular-tipped lobes each terminating in a yellow-colored spine (2–)5(–12) mm long. Heads solitary, borne in leafy panicles. Involucre globose in bud, campanulate at maturity, 25–45 mm high,

Table 1. Significance of canonical correlations between Gila, Santa Fe, and intermediate phenotypes.

Test of HO: The canonical correlations in the current row and all that follow are zero					
	Likelihood ratio	Approx F	Num DF	Den DF	Pr > F
1	0.14728959	5.0845	24	76	0.0001
2	0.75470889	1.1523	11	39	0.3502

Table 2. Total canonical structure between Gila, Santa Fe, and intermediate phenotypes.

Character	CAN1	CAN2
Corolla tube length	0.206	0.210
Corolla throat length	−0.378	−0.016
Corolla lobe length	−0.432	0.172
Style tip length	0.546	−0.011
Anther appendage tip length	0.620	0.184
Anther appendage body length	−0.693	−0.103
Pappus length	−0.091	0.470
Phyllary length	0.214	0.223
Phyllary spine length	0.560	0.436
Terminal leaf spine length	0.444	0.471
Decurrence length of leaf base	0.423	0.201
Leaf length	−0.293	0.223

Table 3. Comparison of means between subspecies. All measurements in mm. All vegetative characters measured at 3rd leaf below capitulum. All variables differed significantly ($P < 0.01$) between subspecies in the Kruskal-Wallis comparison of means.

Character	Subspecies			
	N	*ochrocentrum*	*N*	*martinii*
Corolla tube length	65	18.5 (11–25)	35	16.4 (8–22)
Corolla throat length	65	9.2 (6–12)	35	11.6 (7–17)
Corolla lobe length	65	10.2 (6–12)	35	11.1 (7–15)
Style tip length	64	5.6 (3–8)	33	4.8 (2–7)
Anther appendage tip length	65	1.2 (0.8–2)	34	1.1 (0.7–2)
Anther appendage body length	65	1.6 (0.8–2)	34	2.2 (1–3)
Middle phyllary spine length	65	6.3 (2–12)	35	4.8 (2–12)
Leaf decurrence	49	11.2 (1–30)	23	7.7 (3–36)
Leaf length	48	47.9 (20–133)	24	68.4 (15–134)
Leaf spine length	45	8.0 (2–13)	24	6.5 (0.8–12)

22–45 mm broad. Phyllaries with white glandular ridge when fresh, obscure in dried specimens; margins with scattered arachnoid hairs; tips sometimes red; phyllary spines reflexed at maturity, spines stramineous, 3–12 mm long. Corolla carmine red; lobe and throat of similar length, 7–15 mm; upper tube diameter nearly equal to the throat diameter. Anther appendage free tip opaque, red or pink, rostrate to aristate, 0.8–1.8 mm long. Style tip red or pink, about (3–)5(–7) mm long; ring usually minutely purberulent or trichomes not apparent; style scape longitudinally corrugate below ring. Cypselas compressed or somewhat trigonal, evenly brown or with yellow and reddish streaks, 6.5 mm long. Pappus white, 25–43 mm long; bristles sparsely plumose toward tip, densely plumose toward base, apices slightly expanded.

The distribution of this subspecies largely coincides with the Apachian floristic areas as defined by McLaughlin (1986). The Apachian floristic area includes much of southeastern Arizona and southwestern New Mexico and has close affinities with the flora of the Sierra Madre Occidentale in Mexico. The division between these subspecies closely corresponds to the division between the Gila River Drainage and that of the Rio Grande and Colorado River drainages.

The type material for *C. ochrocentrum* (Gray, 1849) was originally collected from hillsides around Santa Fe, New Mexico. *Cirsium ochrocentrum* subsp. *ochrocentrum*, the "Santa Fe" phenotype, from the New Mexico Rio Grande river valley and points eastward, is a relatively homogeneous morphological group. The more western subspecies *martinii* differs from the typical subspecies in distribution, corolla color, and continuous morphological characters. These taxa separate in phenetic analysis along a discriminant function axis primarily composed of anther appendage tip and body length, phyllary spine length, and style tip length. Morphological intermediates between these two forms are observed in a narrow zone along the Continental Divide. In these areas, populations may have intermediate flower colors to the red or purple phenotypes or mixed populations of both colors. Although these intermediate populations were variable in many characteristics, there is no decrease in pollen stainability or other indications of loss of fertility in these areas (Barlow, 1992). The subspecies rank is appropriate to separate these taxa for the following reasons: (1) there is intergradation between the Gila phenotype and more typical Santa Fe thistles in the zone of contact between them; and (2) these taxa have overlapping distributions of characters, which only differ in population means. It is also of note that in populations of what superficially appears to be the typical subspecies in Jeff Davis County, Texas, specimens have extremely short style tips, and may be another segregate of *Cirsium ochrocentrum*. Although Hsi (1960) discussed this red-corolla form of *C. ochrocentrum*, my analysis does not support recognition of a taxon based on cypsela as a diagnostic characteristic (Table 3).

The subspecies *martinii* may be distinguished in the field from subspecies *ochrocentrum* by its bright-red florets, short style tips and spines, and less prominent decurrence of leaf bases. It differs from *Cirsium arizonicum*, another species with red corollas, by its globose involucres and its large capitula with more than 120 florets per head as compared to fewer than 60 florets in the cylindrical capitula of the Arizona thistle.

This subspecific epithet commemorates William

C. Martin, who inspired a generation of students with his love of plants and his dedication to botanical education.

Paratypes. U.S.A. **Arizona:** Cochise County, 6 mi. E of Portal, *Cazier 114971* (ARIZ); Huachuca Mts., *Lemmon 2790* (US); Miller Canyon Rd. in Huachuca Mts., *McGill & Lehto 87615* (ASU). Graham County, Ft. Grant, *Shreve 5213* (ARIZ). Mojave County, 3 mi. NW of Mt. Dellenbaugh on Shivwits Plateau, *Holland 745* (UNLV); T34N, R12W, S32 along roadside, *Coombs & Bundy 2597* (ARIZ). Navajo County, Heber, *Lehto 1984* (ASU); Fort Apache, *Whitehead & Bolles 1626* (ARIZ). Pima County, just N of Ophir Gulch, 4 mi. N & 2 mi. W of Sonoita, *Tramanto t-10* (ARIZ). Santa Cruz County, along Rt. 82, 1.8 mi. S of junction of Rt. 83, *McGill & Pinkava 6730* (ASU); Ted Knipe Property, ca. 3 mi. W of Sonoita on Rt. 82, *Reeves & Lehto 67561* (ASU). Yavapai County, Mingus Mt., Mingus Water Shed, station B., *Demaree 46081* (ASC); 1 mi. from Perkinsville, *C. Grue 72A024* (ASC); 1.5 mi. S of Dewey on AZ 69, *Keil K11448* (ASU, WTS). **New Mexico:** Catron County, cliff, *Castetter 8362* (UNM); road cut across rock outcrop, 3 mi. W of Reserve, *Weber & Salamun 12801* (COLO, UT); Lower Plaza, Frisco, *Wooton 1900* (NMC). Grant County, Gila NF, T21S, R16W, 8 mi. S of Silver City, *Gentry & Jensen 2274* (BRY, COLO, ARIZ); 15 mi. S of Red Rock, *Maquire, Ranchards & Moeller 11424* (ARIZ). Hidalgo County, 5 mi. S of Hachita, *Castetter 10370* (UNM); 1 mi. N of Rodeo, *Cazier 431* (ASU); Arroyos W of Hermanos, *Clark 10740* (UNM). Luna County, Cook, *A. T. Hyatt 1907* (NMC).

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A New Species of *Monochilus* (Lamiaceae) from Brazil

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ABSTRACT. A new species, *Monochilus obovatus* P. D. Cantino, is described from Goiás, Brazil. It differs from the only previously known species of *Monochilus* in leaf shape, calyx size, and corolla shape.

The genus *Monochilus* Fischer & C. A. Meyer has traditionally been placed in the Verbenaceae but was transferred to Lamiaceae by Cantino et al. (1992), along with many other genera formerly classified as Verbenaceae. *Monochilus* is unusual in having alternate to subverticillate leaves and a racemose inflorescence, whereas most Lamiaceae have opposite leaves and a cymose inflorescence (often a thyrse). Racemes and alternate leaves also occur frequently but not universally in *Amasonia* L. f., probably the closest relative of *Monochilus*. The two genera are distinguished by corolla shape (unilabiate in *Monochilus* vs. subactinomorphic to weakly zygomorphic in *Amasonia*) and the absence in *Monochilus* of the brightly colored calyx and floral bracts that characterize *Amasonia*.

Until now, *Monochilus* was thought to be monotypic, comprising only *M. gloxiniifolius* Fischer & C. A. Meyer, which is endemic to the states of Rio de Janeiro and Espírito Santo in coastal southeastern Brazil. The new species described here, *Monochilus obovatus*, is known only from two flowering specimens collected in gallery forest in Goiás cerrado, about 600 miles northwest of the nearest known locality of *M. gloxiniifolius*. The first specimen (US) was encountered in the process of preparing a description of the genus for Kubitzki's (1990–) *Families and Genera of Vascular Plants*. A duplicate (MBM) was subsequently borrowed from the collector, G. Hatschbach, but attempts to locate other specimens in Brazilian herbaria were unsuccessful.

Monochilus obovatus has the diagnostic features of the genus (i.e., alternate leaves, racemose inflorescence, unilabiate corolla) but differs from *M. gloxiniifolius* in four characters. The leaves of *M. gloxiniifolius* are ovate to elliptical, with a petiole 1–3 cm long; those of *M. obovatus* are narrowly obovate to oblanceolate and either sessile (US specimen) or tapering gradually to a petiole up to 1.5 cm long (most leaves on the MBM specimen). The flowering calyx of *M. gloxiniifolius* is 5–6 mm long, vs. 8.5–11 mm long in *M. obovatus*. The corolla limb of *M. gloxiniifolius* is shorter than the tube, whereas the corolla limb in *M. obovatus* is much longer than the tube. Although few specimens of either species exist, the four distinctions noted here, together with the 600-mile separation of their ranges, strongly suggest that they represent distinct species.

Calyx shape is variable in *Monochilus obovatus*. In the MBM specimen, the calyx is subactinomorphic as in *M. gloxiniifolius*, whereas the sinus between the lower two calyx lobes in the US specimen is much deeper than the other four sinuses. If additional collections are made in the future, examination of this character in a larger sample of both species would be worthwhile.

Monochilus obovatus P. D. Cantino, sp. nov. TYPE: Brazil. Goiás: São João da Aliança, rodovia para Vâozinho, mata de galeria (zona de cerrado), 9 Feb. 1994, *G. & M. Hatschbach 60244 & J. M. Silva* (holotype, US #3290138; isotype, MBM #165645).

A *Monochilo gloxiniifolio* foliis anguste obovatis, calyce 8.5–11 mm longo, et limbo corollae tubo longiore differt.

Perennial herb, pubescent with ± straight, multicellular, nonglandular hairs, more densely so upward. Leaves alternate to subverticillate, clustered below inflorescence, sessile or tapering to a petiole; petiole (if present) up to 1.5 cm long; blade 7–11 cm long, 2.5–4 cm wide, narrowly obovate to oblanceolate, cuneate at base, broadly acute to obtuse at apex, denticulate; upper surface evenly pubescent with ± straight hairs; lower surface densely pubescent on principal veins, sparsely so elsewhere. Inflorescence a terminal raceme, hirsute; bracts narrowly oblanceolate, 5–8 mm long; bracteoles paired in upper half of pedicel, linear. Calyx (in flower) 8.5–11 mm long, exteriorly hirsute, subactinomorphic to zygomorphic, sinus between lower 2 lobes sometimes much deeper than other sinuses; tube campanulate; lobes 5, ovate to broadly lanceolate, acute to attenuate. Corolla white, unilabi-

ate (upper lip only); tube cylindrical, deeply cleft on lower side, 5 mm long; limb 5-lobed, 8–9 mm long, 4 outer lobes oblong to ovate, median lobe obovate and larger than others. Stamens 4, slightly didynamous, attached near top of corolla tube, slightly exserted from tube; filaments pubescent at base; anther thecae parallel, not confluent at dehiscence. Ovary unlobed; style apex with two very short, equal to subequal lobes. Fruit unknown.

Key to the Species of *Monochilus*

1a. Leaves ovate to elliptical, petiole 1–3 cm long; flowering calyx 5–6 mm long; corolla limb shorter than tube; coastal southeastern Brazil . . . . . *M. gloxiniifolius*

1b. Leaves narrowly obovate to oblanceolate, sessile or with petiole up to 1.5 cm long; flowering calyx 8.5–11 mm long; corolla limb much longer than tube; Goiás . . . . . *M. obovatus*

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A New Subgenus and Fifteen New Species of *Echeandia* (Anthericaceae) from Mexico and the United States

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ABSTRACT. Two subgenera in *Echeandia* (Anthericaceae), i.e., subg. *Echeandia* and subg. *Mscavea*, are recognized based on time of flower opening, tepal shape, flower color, and habitat differences. Fifteen species are proposed. One, *E. texensis*, is based on four collections made near Brownsville, Texas, and is surely rare, possibly extirpated. The recognition of five species clarifies the distributional range of *E. reflexa*, a common species of eastern Mexico. Seven species are endemic to Guerrero and adjacent areas of Michoacán, México, Morelos, and/or Oaxaca. A key to the species of subgenus *Mscavea* and white-flowered species of subgenus *Echeandia* is provided.

Echeandia, as described by Ortega (1800: 135, tab. 18), included New World species with connate anthers and scaled filaments. These traits effectively separated *Echeandia* and Old World *Anthericum*, which had free anthers and smooth or papillate filaments. With few exceptions, New World species with free anthers were included in *Anthericum* for the next 180 years. However, during that time, species with smooth filaments were included in *Echeandia* (see Weatherby, 1910), and species with scaled filaments were described in *Anthericum* (Baker, 1876; Greenman, 1898). Thus, for the past century or more, New World *Anthericum* and *Echeandia* were separated simply on the nature of their anthers, and the unique traits they shared were ignored. Because most New World species described in *Anthericum* and *Echeandia* share traits that are unique in Anthericaceae, including a corm and scaled filaments, they are now included in *Echeandia* (see Cruden, 1987, 1994), which, with 78 described species, is the second largest genus in Anthericaceae (see Chase et al., 1996; Dahlgren et al., 1985: 186). Excluded from *Echeandia* are approximately 20 white-flowered South American species with smooth filaments and free anthers that probably constitute an undescribed genus.

Within *Echeandia* there are two distinct lineages, and each includes species with free anthers and others with connate anthers. The two lineages share at least two synapomorphies. First, all *Echeandia* have a corm that produces new storage roots and inflorescences yearly. Other Anthericaceae are rhizomatous, and only the terminal segment produces leaves and inflorescences. There is no evidence that a segment produces inflorescences in successive years. Second, most genera in Anthericaceae s. str. have smooth and/or papillate filaments, e.g., *Chlorophytum* s.l. (Kativu & Nordal, 1993) and *Hagenbachia* (Cruden, 1987), whereas most *Echeandia* (63/78) have scaled filaments and those with smooth filaments occur in derived groups.

In addition, anthers adapted for pollination by vibratory bees occur in both lineages and are unique in Anthericaceae s. str. In the white-flowered lineage the anthers in 21 of 25 species are connate and form a cone, and in the other 4 species the individual anthers are adapted for buzz pollination (see below). In the yellow-flowered lineage, 19 of 53 species have anther cones and in 4 additional species the individual anthers are adapted for buzz pollination. The filaments of all these species are inserted dorsally within a basipetally opening pocket, which effectively holds the anther on the same axis as the filament and probably provides the structural stability needed to support a bee while it vibrates an anther or anther cone. It is possible that connate anthers constitute a parallel apomorphy. In other *Echeandia* and most other Anthericaceae, the anthers are free, usually versatile, dorsifixed, and dehisce laterally. In most *Chlorophytum*, however, the filaments are inserted more or less basally in a deep pit, which restricts the movement of the anthers.

Finally, relative to *Echeandia*'s putative ancestor, both lineages combine a mixture of primitive and derived traits. Based on other Anthericaceae, that ancestor had white flowers, which probably opened relatively early in the morning, broadly elliptical tepals, smooth filaments, and versatile anthers that dehisced laterally. Thus, yellow flowers are apomorphic in one lineage, as are narrowly elliptical inner tepals and late opening flowers in the other.

Thus, the available data are consistent with a common ancestor diverging into two lineages, which are formally recognized below as subgenera.

The two lineages share several synapomorphies and are separated by a number of apomorphies. Further, the two lineages tend to occur in different climatic zones (see below). I include the two lineages in *Echeandia* as subgenera because the differences that separate them do not appear to be as great as those separating other genera in Anthericaceae. However, a more detailed examination of the relationships among genera in Anthericaceae using other techniques might lead to a different conclusion.

Subgenus *Mscavea* is proposed to include species in the white-flowered lineage, whose flowers open late in the morning or in the afternoon, and have narrow inner tepals. This subgenus honors Marion S. Cave, eminent embryologist and student of the Liliaceae s. lat., who stimulated my interest in Mexican Liliaceae in general and *Echeandia* in particular.

Echeandia subg. **Mscavea** Cruden, subg. nov. TYPE: *Echeandia mcvaughii* Cruden, Contr. Univ. Michigan Herb. 16: 129. 1987. [Illustrated in McVaugh, 1989: 187.]

Ab *Echeandia* subg. *Echeandia* tepalis interioribus anguste ellipticis albis vel cremis raro flavis, floribus aperientibus ante vel post meridiem differt.

The two subgenera differ in time of flower opening, tepal shape, width, and color, capsule shape, and altitudinal distribution. The flowers of species in *Echeandia* subg. *Echeandia* open shortly before or after sunup. All but 1 of 53 species have broadly elliptical inner tepals. In the 40 species for which I have reasonable data, the minimum width of the inner tepal in 27 species was 4.5 mm, and the median width exceeded 4.5 mm in 36 species. Most of the species (44/53) are yellow-flowered, and six include white-flowered populations. Nine species are white-flowered. In contrast, in subgenus *Mscavea*, the flowers open late in the morning or the afternoon, 24 of 25 species have narrowly elliptical inner tepals, and, in 22 of 23 species for which I have reasonable data, the maximum width of the inner tepal was 4.5 mm. Most of the species have white flowers (22/25), two have cream-colored flowers, one has orange flowers, and one, possibly two, species include orange- or yellow-flowered populations.

Capsule shape differs significantly between the two subgenera ($\chi^2 = 13.91$, $p \gg 0.001$; analysis with a contingency table and Chi-square test). For those species in subgenus *Echeandia* for which there are data, 26 have oblong capsules (length at least twice the width) and 16 have subglobose to broadly oblong capsules, whereas just 2 species in subgenus *Mscavea* have oblong capsules, and 17 have subglobose to broadly oblong capsules.

Table 1. Distribution of species in subgenus *Echeandia* and subgenus *Mscavea* as a function of elevation. A species was assigned to a given category if most of its elevational range was included in that category. The range of two species in *Echeandia* extended from slightly below 800 m to 2400 m. They were counted as being half in one category and half in the other category.

	Below 800 m	800–1500 m	1500–2400 m	above 2400 m
Subg. *Echeandia*	6	8	30	9
Subg. *Mscavea*	8	12	5	0

Relative to species in subgenus *Mscavea*, those in subgenus *Echeandia* tend to occur at higher elevations (Table 1; $\chi^2 = 19.84$, $p \ll 0.001$). Most species in subgenus *Echeandia* (>70%) occur completely or primarily above 1500 m, and nine occur above 2400 m, whereas 80% of the species in subgenus *Mscavea* occur completely or primarily below 1500 m, and only four reach 2400 m. It is not obvious that a disproportionate number of species in subgenus *Mscavea* relative to subgenus *Echeandia* occur below 800 m ($\chi^2 = 4.93$, $p < 0.05$). In essence, most species in subgenus *Mscavea* occur in drier habitats with subtropical to warm-temperate climates, whereas most species in subgenus *Echeandia* occur in relatively mesic habitats with warm- to cold-temperate climates.

The occurrence of connate anthers is not equivalent in the two subgenera. Only 19 of 53 species in subgenus *Echeandia* have connate anthers, compared to 21 of 25 species in subgenus *Mscavea*. Because most species in subgenus *Mscavea* have connate anthers, one might anticipate that species with connate anthers occur at lower elevations. However, there is no relationship between occurrence of connate anthers and elevation in either subgenus *Echeandia* ($\chi^2 = 1.18$, $p > 0.5$) or subgenus *Mscavea* ($\chi^2 = 0.09$, $p > 0.975$).

Among those species with connate anthers, the two subgenera differ with respect to the insertion of the filaments, which is either dorsal and hidden within a pocket or between the anther sacs and essentially basal. In most species of subgenus *Mscavea* (12/20 examined), the distance from the lower edge of the pocket to the base of the anther is shorter than in 18 of 19 species in subgenus *Echeandia* examined (0.1–0.6 mm vs. 0.6–2.0 mm; $\chi^2 = 13.137$, $p \ll 0.001$). There is no correlation between anther length and distance from the lower

edge of the pocket to the base of the anther in either subgenus *Echeandia* ($r = 0.289$, $n = 19$, $p \gg 0.05$) or subgenus *Mscavea* ($r = 0.237$, $n = 20$, $p \gg 0.05$). Finally, in six species of subgenus *Mscavea* but just one of subgenus *Echeandia*, insertion of the filaments is basal or essentially so.

Among species with free anthers, the anthers of all four species in subgenus *Mscavea* dehisce apically compared to 4 of 33 species in subgenus *Echeandia*. In three species of subgenus *Mscavea*, the line of dehiscence is fused ⅓–⅔ the length of the anther, and dehiscence is through a relatively large teardrop-shaped opening. In one species of subgenus *Mscavea* and the four species of subgenus *Echeandia*, the line of dehiscence is completely open, and dehiscence is through a much smaller apical opening.

Key to Mexican Subgenus *Mscavea* and White-flowered Subgenus *Echeandia*

In any couplet, a clause preceded by "if" takes precedence over other clauses. Leaf shape follows that proposed by the Systematics Association Committee (1962). The names of species described in this paper are not followed by the author's name. The subgenus of each species is given: (E) = subg. *Echeandia*, (M) = subg. *Mscavea*. See also keys in McVaugh (1989) and Cruden (1994).

1. Anthers free 2
1. Anthers connate, forming a cone 3
2(1). Filaments smooth 4
2. Filaments scaled 7
3(1). Filaments smooth 20
3. Filaments scaled 26

Anthers Free, Filaments Smooth

4(2). Scapes with scattered enations or glabrous . . 5
4. Scapes hirsute or scabrous, at least in lower half, frequently throughout 6
5(4). Anthers not versatile, line of dehiscence partially fused, bases flared; tepals narrowly elliptic, 6–8 mm long (below 1200 m, Jalisco) . . . . . *E. pihuamensis* Cruden (M)
5. Anthers versatile, dehiscence lateral, bases straight; tepals broadly elliptic, 8–13 mm long (above 1600 m, Durango and San Luis Potosí to México) . . . . . *E. durangensis* (Greenman) Cruden (E)
6(4). Basal leaves narrowly linear, veins papillate below, margins ciliate, if tips strongly recurved (1800–1900 m, Oaxaca, Puebla) . . . . . *E. parva* Cruden (E)
6. Basal leaves narrowly ovate to narrowly elliptic, flat, veins smooth below, margins entire or nearly so, tips straight (mostly above 2000 m, San Luis Potosí to Veracruz and Puebla W to Michoacán) . . . . . *E. nana* (Baker) Cruden (E)

Anthers Free, Filaments Scaled

7(2). Eastern Mexico (Tamaulipas, San Luis Potosí, Veracruz, Tabasco, Campeche) below 500 m 8
7. Elsewhere in Mexico and/or at higher elevations 9
8(7). Flowers white (Tamaulipas) . . . . . *E. tamaulipensis* (E)
8. Flowers yellow-orange (Campeche) . . . . . *E. campechiana* Cruden (M)
9(7). Basal leaves 2–6 mm wide, 5–15 cm long, margin long ciliate, veins on lower surface papillate and/or bearing long hairs; storage roots 4–10 cm from the corm (Oaxaca) . . . . . *E. confertiflora* Cruden (E)
9. If most basal leaves wider or longer, margin entire to ciliate, and/or the veins smooth below; if storage roots enlarged 1–2 cm from the corm 10
10(9). Anthers dehisce apically; anther walls not reflexed but may be open along line of dehiscence and the wall flared at apex; most more than 3 mm long 11
10. Anthers dehisce laterally; anther walls reflexed, if anthers twisted or obviously versatile; most less than 3 mm long (sometimes longer in *E. gentryi* (M) and *E. durangensis* (E)) 14
11(10). Cauline leaves 7–11, becoming white when dry; storage roots close to the corm; basal leaves more than 20 mm wide (Jalisco) . . . . . *E. robusta* Cruden (M)
11. Cauline leaves 1–6, if more, then storage roots 4–10 cm from the corm; if basal leaves less than 20 mm wide 12
12(11). Tepals 7–8 mm long; line of dehiscence partially fused (Oaxaca, Puebla) . . . . . *E. mirandae* Cruden (M)
12. Tepals 11–21 mm long; line of dehiscence completely open 13
13(12). Ovaries 3–4 mm long (Puebla) . . . . . *E. michoacensis* (Poellnitz) Cruden (E)
13. Ovaries 2–3 mm long (Chiapas) . . . . . *E. matudae* Cruden (E)
14(10). Scapes pubescent, sometimes weakly so or only near the base 15
14. Scapes glabrous 16
15(14). Storage roots enlarged 1–4 cm from corm; margins of basal leaves ciliate to long ciliate; scape scabrescent, at least toward the base (Chihuahua and Nayarit SE to Michoacán) . . . . . *E. scabrella* (Bentham) Cruden (E)
15. Storage roots enlarged 3–8 cm from corm; margins of basal leaves denticulate; shoot with minute scattered hairs in lower half (Oaxaca) . . . . . *E.* sp. (E)
16(14). Filaments 9–15 mm long; most basal leaves 1–6 mm wide; if style scaled (Guerrero, México, Morelos) . . . . . *E. tenuis* (Weatherby) Cruden (E)
16. Filaments less than 8 mm long; or if most basal leaves more than 6 mm wide 17
17(16). Basal leaves 1–7 mm wide, narrowly linear to linear, margins denticulate; most storage roots enlarged 3–8 cm from corm; capsules subglobose to broadly oblong (length < twice the width) (Oaxaca, Puebla) . . . . . *E. graminea* Martins & Galeotti (E)

17. If most basal leaves 7 or more mm wide; storage roots enlarged 1–3 cm from corm; if capsules oblong (length at least twice the width) 18
18(17). Basal leaves 1–6 mm wide, narrowly linear; filaments inserted in a pocket, not versatile; ovaries 1.8–2.5 mm long (Jalisco, Nayarit, Sinaloa, Durango) . . . . . *E. gentryi* Cruden (E)
18. If most basal leaves 7 mm or more wide; ovaries 2.5–4 mm long 19
19(18). Leaves broadly linear to narrowly ovate; anthers versatile (above 1600 m, mts. of Durango and San Luis Potosí S to México and Hidalgo) . . *E. durangensis* (Greenman) Cruden (E)
19. Leaves linear, frequently falcate; anthers not versatile due to reflexed anther walls. (Guanajuato) . . . . . *E. sanmiguelensis* (E)

Anthers Connate, Filaments Smooth

20(3). Basal leaves abruptly expanded near the middle into a broad blade, appearing petiolate (Guerrero) . . . . . *E. pseudopetiolata* (M)
20. Width of basal leaves not changing abruptly 21
21(20). Scapes scabrous beyond first cauline leaf and/or if basal margins of leaves ciliate to long ciliate 22
21. Scapes glabrous or rarely scabrescent near the base 25
22(21). Scapes usually more than 1 m high, cauline leaves 6–15; basal leaves 15–40 mm wide (rarely narrower), margin entire to short ciliate; tepals 9–13 mm long (Guerrero, Morelos) . . . . . *E. mexiae* (M)
22. Scapes rarely 1 m high; if cauline leaves 0–4, if most basal leaves less than 10 mm wide, their margins ciliate to long ciliate, and/or tepals less than 9 mm long 23
23(22). Basal leaves 2–11 mm wide, most less than 10 mm wide, flat, margin entire to denticulate; tepals 8.5–10.5 mm long; anthers (1.8–)2–3 times the length of the filaments; scapes 15–40 cm high (below 500 m, Jalisco, Sinaloa) . . . . . *E. sinaloensis* Cruden (M)
23. If most of the basal leaves more than 10 mm wide, falcate, their tips strongly recurved, or the margin ciliate to long ciliate; if tepals less than 8 mm long; anthers 1–1.6(–2) times the length of the filaments; if scape more than 50 cm high 24
24(23). Basal leaves 6–12 mm wide, very narrowly linear to very narrowly elliptic, frequently falcate and/or with strongly recurved tips, frequently undulate, margins densely ciliate to long ciliate (rarely denticulate or short ciliate) (Jalisco, Colima SE to Oaxaca, Chiapas, and Guerrero to Veracruz) . . . *E. parviflora* Baker (M)
24. Basal leaves (8–)13–28 mm wide, flat, narrowly ovate to narrowly elliptical, margins entire to minutely denticulate (below 800 m, Guerrero, México) . . . . . *E. atoyacana* (M)
25(21). Capsules globose, 2.5–4 mm long; basal leaves 4–8, 6–15 mm wide; cauline leaves 2–6 (Jalisco, Nayarit) . . . . . *E. parvicapsulata* Cruden (M)
25. Capsules broadly oblong, 6–10 mm long; basal leaves 7–13, if most more than 15 mm wide; cauline leaves (4–)5–10 (Sonora, Chihuahua, to Guerrero) . . . . . *E. ramosissima* (Presl) Cruden (M)

Anthers Connate, Filaments Scaled

26(3). Eastern Mexico (Tamaulipas, San Luis Potosí, Veracruz, Campeche, Yucatán) below 1600 m; if flowers cream-colored 27
26. Elsewhere in Mexico or above 1800 m . . . 29
27(26). Flowers cream-colored (Campeche, Quitana Roo, Yucatán, Oaxaca) . . . . . *E. luteola* Cruden (M)
27. Flowers white 28
28(27). Anthers 7–9 mm long, twice the length of the filaments; leaf margins ciliate to long ciliate (Tamaulipas, San Luis Potosí) . . . . . *E. macrophylla* Rose (M)
28. Anthers 4–7 mm long, barely longer than the filaments; leaf margins denticulate to ciliate (Veracruz) . . . . . *E. albiflora* (Schlechtendal & Chamisso) Martins & Galeotti (M)
29(26). Apexes of anther cones 1.2–3.5 mm wide; anther cones 2.5–4.0 mm wide and 4–5(–7) mm long; basal leaves 2–7 mm wide, veins on lower surface noticeably papillate (Oaxaca) . . . . . *E. conzattii* Cruden (E)
29. If apexes of anther cones less than 1 mm wide, or anther cones less than 2 mm wide; if basal leaves smooth below and/or most more than 10 mm wide; if storage roots enlarged 1–3 cm from corm 30
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33(31). Anthers 1–1.6 times the length of the filaments; capsules 7–11.5 mm long (above 800 m, Nayarit) . . . . . *E. flexuosa* Greenman (E)
33. Anthers 1.8–2.2 times the length of the filaments; capsules 5–7 mm long. (below 500 m, Nayarit, Sinaloa) . . . . . *E. nayaritensis* (M)
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34. Scapes glabrous 39
35(34). Leaf margins long ciliate, hairs usually 0.2–0.5 mm long; scapes usually hirsute, hairs long and flat; basal leaves (10–)15–40 mm wide

(Guerrero, México, E Michoacán) . . . . . *E. hirticaulis* (M)

35. Leaf margins entire to ciliate, rarely long ciliate; scapes mostly scabrescent; if most basal leaves 2–8 mm wide 36

36(35). Leaf margins ciliate to long ciliate, sometimes densely so; basal leaves 2–8 mm wide, frequently falcate; anthers 3–7 mm long, most 1.2–1.8 times the length of the filaments; tepals 7.5–12 mm long; basal leaves 1–8 mm wide . . . . . *E. parviflora* Baker (M)

36. Leaf margins entire to short ciliate, rarely ciliate; if most basal leaves more than 10 mm wide; if anthers 7.5–12 mm long and/or 1.8–2.2 times the length of the filaments; if tepals more than 12 mm long 37

37(36). Storage roots enlarged 4–8 cm from corm; if lower leaf surface minutely papillate between the veins; capsules 7–9 mm long (Guerrero) . . . . . *E. hintonii* (M)

37. Storage roots enlarged 1–2 cm from corm; lower leaf surface smooth between the veins; if capsules shorter or longer 38

38(37). Anther cones 6–11 mm long, usually widest in the middle; if anthers 1.8–2.2 times the length of the filaments; capsules 4–7 mm long; basal leaves 5–10, frequently falcate, if most more than 15 mm wide and/or less than 25 cm long (Jalisco, Nayarit) . . . . . *E. mcvaughii* Cruden (M)

38. Anther cones 5.5–7 mm long, 1–1.4 times the length of the filaments, usually widest toward the base; capsules 9–12 mm long; basal leaves 3–5, narrowly elliptic, straight, 6–12 mm wide and more than 30 cm long (Oaxaca) . . . . . *E. oaxacana* Cruden (M)

39(34). Most storage roots enlarged 3–8 cm from corm; anther cones widest toward the base, tapered gradually to the apex, usually 1–1.7 times the length of the filaments 40

39. Most storage roots enlarged 1–3 cm from corm; if anther cones widest in middle and/or 1.8–3 times the length of the filaments 41

40(39). Tepals 9–13 mm long; anther cones 4–8 mm long; cauline leaves 1–5; if underside of basal leaves minutely papillate between veins (Guerrero) . . . . . *E. hintonii* (M)

40. Tepals 13–20 mm long; anther cones 8–12 mm long; cauline leaves 4–10; basal leaves smooth below (Guerrero, Morelos) . . . . . *E. elegans* (M)

41(39). Tepals 9–11 mm long; anther cones 5.5–8 mm long, usually widest near the base and gradually tapered to the apex; basal leaves narrowly linear, 30–45 cm long, 5–14 mm wide, not falcate (Michoacán) . . . . . *E. coalcomanensis* Cruden (M)

41. Tepals 10–19 mm long; anther cones 6–12 mm long, if cones widest in middle; if most basal leaves falcate, less than 20 cm long, and/or more than 15 mm wide 42

42(41). Basal leaves 4–8 mm wide, narrowly linear, straight; ovaries 1–2 mm long (below 600 m, Nayarit, Sinaloa) . . . . . *E. nayaritensis* (M)

42. Basal leaves 10–30 mm wide, most narrowly obovate or narrowly elliptic, frequently falcate; ovaries 2–3 mm long (above 1200 m, Jalisco, Nayarit) . . . . *E. mcvaughii* Cruden (M)

Fifteen species are proposed below: eight in subgenus *Echeandia* and seven in subgenus *Mscavea*.

The species in subgenus *Echeandia* with connate anthers comprise the taxonomically most difficult group in the genus and include *E. reflexa* (Cavanilles) Rose, the type species of the genus. Because this species is quite variable and has a broad geographical range, and given the lack of recent systematic analysis, it is not surprising that specimens with connate anthers from eastern and central Mexico, as well as elsewhere, were included, indiscriminately, in *E. reflexa*. I propose *E. pseudoreflexa* and *E. texensis* to include such material from Chiapas (Cruden, 1994) and Texas (see Johnston, 1990), respectively; *E. palmeri* is proposed to include specimens from Durango and Chihuahua. Only *E. pseudoreflexa* appears to be closely related to *E. reflexa* (see below). The description of two additional species should clarify the distribution of *Echeandia* in eastern and central Mexico. *Echeandia falcata* is proposed to include plants from Querétaro and Guanajuato with relatively short, broad anther cones, and *E. taxcana* is proposed to included narrow-leaved plants with strongly tapered anther cones from Oaxaca, Guerrero, Morelos, and México.

With the recognition of these species, *E. reflexa* is a more coherent, albeit variable, entity found primarily between 200 and 3000 m on the eastern slopes of the Sierra Madre Oriental and adjacent parts of the Sierra Volcánica Transversal from central Nuevo León and southern Tamaulipas to southern Puebla, adjacent Oaxaca, and Veracruz. Populations from low elevations are usually robust, with highly branched inflorescences, and long, broad straight leaves. At mid elevations, the plants are less robust with fewer branches and narrower, shorter leaves; and at high elevations, the leaves are usually narrow and frequently falcate. Specimens from higher elevations in Puebla and adjacent Veracruz and Oaxaca have falcate, undulate basal leaves and resemble small specimens of *E. paniculata* Rose. Flowers of *E. reflexa* have a long (6–9 mm), slender, strongly tapered anther cone, which usually has a small, minutely lobed apex.

Figure 1. Distributional ranges of the eight new species in subgenus *Echeandia* are illustrated.

1. Echeandia pseudoreflexa Cruden, sp. nov. TYPE: Mexico. Chiapas: road to Venustiano Carranza, ca. 3 km SW of Santa Rosalia, hillside with *Convolvulus, Calliandra, Lantana, Dahlia,* 1200 m, 3 Sep. 1971, *Cruden 1936* (holotype, UC; isotypes, MEXU, MO).

Radicibus penariis a cormo 1–3 cm, foliis basalibus anguste linearibus vel anguste ellipticis 7–12 mm latis marginibus denticulatis ad breviciliatis, scapis glabris, tepalis flavis, filamentis squamosis, antheris connatis 5–7.5 mm longis, conis antherarum ad apicem valde contractis.

Storage roots enlarged 1–3 cm from corm. Basal leaves 5–8, narrowly linear to narrowly elliptical, 34–64 cm long, 7–12 mm wide, denticulate to short ciliate. Scapes glabrous, 0.6–1.5 m high, 2–6-branched, major axis with 12–20 flower-bearing nodes. Cauline leaves (0–)2–6, lowest 17–24(–32) cm long, usually exceeding the next node. Flowers yellow, nutant. Tepals 11–16 mm long, inner broadly elliptic 5 mm wide, outer elliptic 2.5 mm wide (one flower examined). Filaments scaled, narrowly clavate, 5–7 mm long, insertion dorsal in a pocket. Anthers connate, 5–7.5 mm long, equal to or slightly longer than the filaments; the cones strongly tapered, apex barely emarginate to shallowly and broadly lobed 0.5–0.8(–1.2) mm wide. Ovaries 2.5–4 mm long. Capsules oblong to narrowly oblong, 9–14.5 mm long, 4.5–5.5 mm wide. In flower August–September, December. Chromosome number $n = 16$ (*Cruden 1936*).

With the exception of material collected near La Ciénega de León, this species is known only from central Chiapas between 1100 and 1800 m (Fig. 1). It occurs in forests dominated by some combination of pine, oak, and *Liquidambar.*

Material of *E. pseudoreflexa* was included in *E. reflexa* in *Flora Mesoamericana* (Cruden, 1994) because of its robust shoots and leaves and strongly tapered anther cone. It is distinguished from most populations of *E. reflexa* by storage roots that are enlarged 1–3 cm from the corm, narrower basal leaves, and the bases of the previous year's leaves forming a fibrous collar. The storage roots of *E. re-*

flexa are usually enlarged 3–6 cm from the corm, and the previous year's leaf bases remain more or less intact. The long, lower cauline leaf distinguishes this species from many specimens of *E. formosa* (Weatherby) Cruden.

Paratypes. MEXICO. **Chiapas**: Ruta 190, 58 km N El Jocote, 7 mi. from La Trinitaria, 1350 m, 19 Sep. 1988, *Stevens & Martinez 25767* (MO); Mpio. Cintalapa, near Oaxaca-Chiapas border, near La Ciénega de León, 1080–1230 m, 1 Dec. 1980, *Breedlove & Almeda 48171* (CAS); Mpio. Pueblo Nuevo Solistahuacán, 3 km NW Pueblo Nuevo Solistahuacán, 5800 ft., 28 Aug. 1970, *Zwill 293* (DS); Mpio. Tenejapa, barrio Tuk, paraje Matsab, 7500 ft., 30 Sep. 1965, *Breedlove 12552* (DS); Mpio. Teopisca, southern limits of Teopisca, 5900 ft., 19 Aug. 1966, *Breedlove 15049* (DS, F).

2. Echeandia texensis Cruden, sp. nov. TYPE: U.S.A. Texas: Green Island, 23–29 June 1922, *Tharp 1129* (holotype, TEX; isotype, US).

Radicibus penariis a cormo 2–4 cm, scapis glabris, foliis basalibus 4–9 linearibus ad ellipticis 10–20 mm latis marginibus denticulatis, tepalis flavis, filamentis squamosis, antheris connatis 4–5.5 mm longis, conis antherarum 2–3 mm latis plerumque filamentis brevioribus.

Storage roots enlarged 2–4 cm from corm. Basal leaves 4–9, 33–60 cm long, 10–20 mm wide, linear to narrowly elliptic, sometimes weakly falcate, minutely denticulate to denticulate. Scapes glabrous, 56–105 cm high, unbranched. Cauline leaves 4–5, (4.3–)10–20 cm long, lowest frequently exceeding the next node. Flowers yellow, nutant. Tepals 12–19 mm long, inner broadly elliptic, 6–8.5 mm wide, outer elliptic, 2.5–3.5 mm wide. Filaments scaled, narrowly clavate, 5–9 mm long, insertion dorsal in a pocket. Anthers connate, 4–5.5 mm long, the cones 2–3 mm wide, usually shorter than the filaments, weakly to strongly tapered, apex 1–1.5 mm wide, deeply and broadly lobed. Ovaries 2–3.5 mm long. Capsules oblong, 9–13 mm long, 4–6 mm wide. In flower June, October–November.

This species is based on four collections made near Brownsville, Texas (Fig. 1), prior to 1952. These suggest a rather limited distributional range, and the lack of recent collections suggests this species is rare and probably endangered, if not already extirpated. The limited data suggest it is a species of clay dunes and llanos.

Specimens of *E. texensis* were included in *E. reflexa* because they have long broad basal leaves, overlapping cauline leaves, and oblong capsules. The short, broad, and deeply lobed anther cones are similar to those of *E. conzattii* Cruden, *E. palmeri* Cruden, *E. flexuosa* Greenman, and *E. falcata* Cruden, all of which have narrower basal leaves, fewer cauline leaves that only occasionally overlap, and anthers that are usually equal to, or longer than, the filaments. *Echeandia texensis* is easily distinguished from *E. reflexa* by the short, usually broad anther cone with a broadly lobed apex.

Paratypes. U.S.A. **Texas:** Cameron County, vicinity Brownsville, 10 m, 25 Oct. 1945, *Runyon 4082* (TEX); Brownsville, *Runyon 4036* (TEX); Loma del Cayo, 29 Nov. 1951, *Johnston & Tharp 38b-1* (TEX).

3. Echeandia palmeri Cruden, sp. nov. TYPE: Mexico. Durango: Santiago Papasquiaro, Apr. & Aug. 1896, *Palmer 410* (holotype, US; isotypes, F, GH, MO, NY).

Radicibus penariis a cormo 2–4 cm, foliis basalibus anguste linearibus 1–7.5 mm latis marginibus denticulatis ad ciliatis, scapis glabris, tepalis flavis, filamentis clavatis squamosis, conis antherarum 3.5–7 mm longis ad apicem infirme contractis.

Storage roots 1.5–3 cm long, enlarged 2–4 cm from corm. Basal leaves 5–9, narrowly linear, (15–)24–40 cm long, (1.5–)3–7.5 mm wide, margins denticulate to ciliate, veins forming the midrib sometimes papillate. Scapes glabrous, (35–)58–74 cm high, bearing 0–2 branches. Cauline leaves 1–2, lowest 3.5–7.6(–13) cm long, rarely reaching next node. Flowers yellow, probably nutant. Tepals 13–19 mm long, inner broadly elliptic, 6–8 mm wide, outer elliptic, 3–4 mm wide. Filaments scaled, narrowly clavate, 4–6 mm long, insertion dorsal in a pocket. Anthers connate, (3.5–)4–7 mm long, the cones widest at base, tapered to apex, 1.5–3.5 mm wide, apex (0.7–)1.1–2.1 mm wide, broadly sometimes coarsely toothed. Ovaries 2.5–5.5 mm long. Capsules oblong, (9–)11–15 mm long, 4.5–6 mm wide. In flower August–September.

The broad, weakly tapered anther cone, narrow leaves, and storage roots enlarged 2 or more cm from the corm are similar to those of *E. conzattii*, *E. flexuosa*, and *E. falcata*. The veins on the underside of the basal leaves of *E. conzattii* are usually papillate, and it has white flowers. In general, *E. flexuosa* and *E. falcata* have more cauline and basal leaves than *E. palmeri*; the basal leaves of many *E. flexuosa* plants are narrower and those of *E. falcata* are falcate.

The specific epithet honors Edward Palmer, noted collector of Mexican plants.

Paratypes. MEXICO. **Chihuahua:** hills near Chihuahua, 6 Sep. 1886, *Pringle 1109* (MEXU, MO, NY). **Sonora:** Yécora, 3 Sep. 1970, *Pennington 103* (TEX); old road to Maycoba, 0.5 mi. E Arroyo Yécora, 1550 m, 7 Sep. 1995, *Fishbein 2478* (MO).

4. Echeandia falcata Cruden, sp. nov. TYPE: Mexico. Guanajuato: Ruta 49, near Km 32, ca. 7 km N San Miguel de Allende, grassy hillside with *Opuntia*, *Ipomoea*, 1880 m, 4 Aug. 1968, *Cruden 1459* (holotype, UC; isotypes, ENCB, F, GH, K, MEXU, MO, NY, US).

Radicibus penariis a cormo 3–5 cm, foliis basalibus 2–12(–14) mm latis linearibus ad anguste ovatis plerumque falcatis marginibus ciliatis, scapis glabris vel ad basim infirme pubescentibus, tepalis flavis, filamentis clavatis squamosis, antheris connatis 4–6.5 mm latis, conis antherarum ad apicem infirme contractis.

Storage roots enlarged 3–5 cm from the corm, usually long-tapered. Basal leaves (5–)7–11(–14), linear to narrowly ovate, weakly to strongly falcate, occasionally straight, 10–52 cm long, 2–12(–14) mm wide, margin short ciliate; veins on lower surface smooth, rarely papillate. Scapes glabrous or weakly scabrous, 15–85 cm high, bearing 0–1(–2) branches. Cauline leaves 2–4, the lowest 1–7.5(–10) cm long. Flowers yellow, nutant. Tepals 13–17 mm long, inner broadly elliptic, 6–8.5 mm wide, outer elliptic, 2.5–5 mm wide. Filaments scaled, clavate to narrowly clavate, 4–6 mm long, insertion dorsal in a pocket. Anthers connate, 4–6.5 mm long, the cones weakly tapered, (1.5–)1.8–2.5 mm wide, (0.8–)1–2(–2.8) mm wide at apex. Ovaries 2.5–4 mm long. Capsules broadly oblong to oblong, (5–)10–13(–16) mm long, 5.5–6.5 mm wide. In flower (late June–)August–September. Chromosome number $n = 16$ (*Cruden 1456, 1459, 1803*).

This tetraploid relative of *E. flexuosa* is endemic to Guanajuato and Querétaro (Fig. 1). Two specimens from Guanajuato have long, non-falcate leaves, but the rest have shorter, usually narrow and strongly falcate leaves. The large flowers with weakly tapered, usually broad anther cones are similar to those of *E. flexuosa* from western Michoacán and eastern Jalisco, and distinguish this species from both *E. reflexa* and *E. mexicana* Cruden of adjacent Hidalgo. The falcate leaves, clavate filaments, and somewhat larger capsules distinguish *E. falcata* from *E. flexuosa*.

Paratypes. MEXICO. **Guanajuato:** Guanajuato, 1880, *Duges s.n.* (GH); Ruta 51, between San Miguel de Allende and Comonfort, 2100 m, 5 July 1971, *Genelle & Fleming 898* (DUKE, MO); 18 km S San Miguel de Allende, 1790 m, 4 Aug. 1968, *Cruden 1456* (ENCB, F, K, MEXU, MICH, NY, UC, WIS); ca. 8 km N San Miguel de Allende, 1880 m, 23 Aug. 1970, *Cruden 1806* (GH, UC). **Querétaro:** E San Miguel de Allende, 15 km E Guanajuato-Querétaro state line, 2125 m, 23 Aug. 1970, *Cruden 1803* (UC); Hacienda Ciervo, between San Juan del Río and Cadereyta, 20 Aug. 1905, *Rose, Painter & Rose 9647* (US); Del Ciervo, 20 Aug. 1905, *Altamirano 1597* (US); road toward Tequisquiapan, 21 Aug. 1903, *Rose, Painter & Rose 9703* (US); Tequisquiapan, 18 Sep. 1957, *Paray 2500* (ENCB); near San Juan del Río, 28 Aug. 1905, *Rose, Painter & Rose 9554* (NY, US); 15 km from Higuerillas toward Bernal, 20°54′N, 99°54′W, 2100 m, 25 June 1972, *Wendt, Chiang & Johnston 8100* (TEX).

5. Echeandia taxacana Cruden, sp. nov. TYPE: Mexico. México: Ruta 55, 6.5 km NW Guerrero State Line, 1485 m, 1 Aug. 1970, *Cruden 1721* (holotype, UC; isotypes, F, GH, K, MEXU, MO, US).

Radicibus penariis 1 cm longis a cormo 1.5–5.5 cm, foliis basalibus peranguste linearibus 1–4 mm latis marginibus denticulatis ad ciliatis, scapis glabris vel ad basim scabridis, tepalis flavis vel albis, filamentis clavatis squamosis, antheris connatis 5–7.5 mm longis, conis antherarum ad apicem valde contractis.

Storage roots enlarged 1.5–5.5 cm from corm, ca. 1 cm long. Basal leaves 5–14, very narrowly linear, (10–)15–55 cm long, 1–3(–4) mm wide, margin denticulate to ciliate. Scape glabrous or scabrescent toward the base, 35–85 cm high, bearing 0–1 branches. Cauline leaves 1–3(–5), lowest 1.6–5.5 cm long. Flowers yellow or white, nutant. Tepals 11.5–15 mm long, inner broadly elliptic, 5–7 mm wide, outer narrowly elliptic, 2–3 mm wide. Filaments scaled, clavate, (4–)5–7 mm long, insertion dorsal in a pocket. Anthers connate, (5–)6–7.5 mm long, the cones usually longer than the filaments, strongly tapered, (1.7–)2–2.5 mm wide, apex shallowly lobed, 0.5–0.9 mm wide. Ovaries 2–4 mm long. Capsules broadly oblong, 7.5–9 mm long, 4–4.5 mm wide. In flower July–October. Chromosome number $n = 8$ (*Cruden 1721, 1953*).

The yellow-flowered populations are found in a variety of habitats, including thorn scrub, oak woodlands, and pine-oak woods in Oaxaca, Guerrero, Morelos, and México between 1400 and 2400 m (Fig. 1). The white-flowered plants are essentially like the yellow-flowered ones, but may be from more mesic habitats. The sampled populations are southeast of the distributional range of the yellow-flowered populations between 2000 and 2600 m.

The numerous narrow leaves, slender inflorescences, and broadly oblong capsules are reminiscent of *E. flexuosa*, from which it is distinguished by the strongly tapered anther cone and small storage roots that usually develop some distance from the corm. The narrow leaves distinguish this species from *E. reflexa*, and it usually has more basal leaves than *E. smithii* Cruden.

The specific epithet honors the city of Taxco de Alcarón, which sits at the northwestern end of distributional range of this species.

Paratypes. MEXICO. **Guerrero:** Taxco Road, 18 July 1938, *Kenoyer A519* (F); 19 mi. from Taxco de Alarcón, 3800 ft., 3 July 1941, *Chute M-108* (MICH). **Morelos:** 1905, *Rose, Painter & Rose 8609* (US). **Oaxaca:** Ruta 190, Km 56, ca. 16 km ESE Tamazulapan, 2350 m, 15 Aug. 1970, *Cruden 1773* (UC), 7 Sep. 1971, *Cruden 1953* (ENCB, K, MEXU, NY, TEX, UC, WIS); Ruta 190, Km 406–407, 26.5 km SE Huajuapan de León, 2270 m, 30 July 1968, *Cruden 1444* (UC).

White-flowered specimens examined. MEXICO. **Oaxaca:** Mpio. San Juan Mixtepec, 16 km S San Juan Mixtepec, Monte de Tesoro, 17°14′N, 97°51′W, 2600 m, 6 Oct. 1988, *Santiago 880* (MEXU); 6.7 km W of Miahuatlán on road to Piedra Larga (Coatlánes), 25 Oct. 1982, *Torres, Martinez & Villasenor 1716* (MEXU); Tlaxiaco, San Pedro Molinos, Km 64 on carretera Tlaxiaco–Putla, 17°14′34″N, 97°43′10″W, 2000 m, 3 Aug. 1994, *Panero & Calzada 4439* (TEX).

6. Echeandia attenuata Cruden, sp. nov. TYPE: Mexico. Sinaloa: Ruta 40, Km 204, ca. 5 km W El Palmito, seepage area with *Begonia, Bidens, Dahlia, Castilleja, Cosmos*, 2000 m, 18 Sep. 1971, *Cruden 1997* (holotype, UC; isotypes, ENCB, F, GH, K, MEXU, MO).

Radicibus penariis a cormo 1–2 cm, 3–4 cm longis, foliis basalibus anguste linearibus attenuatis 1–5(–7) mm latis, scapis glabris vel ad basim scabris 30–90 cm altis, foliis caulibus 2–6 longiattenuatis, tepalis flavis ellipticis valde reflexis, filamentis squamosis unumquidque in marsupio insertis 4–6.5 mm longis, antheris libris non versatilis dehiscens lateralibus.

Storage roots enlarged 1–2 cm from the corm, 3–4 cm long. Basal leaves narrowly linear, attenuate, 23–53 cm long, 1–5(–7) mm wide, margin denticulate to serrulate. Scapes glabrous or scabrescent toward the base, 30–90 cm high, bearing 0–4 branches. Cauline leaves (2–)3–5(–6), long attenuate, lower to 17.5 cm long. Flowers yellow, cernuous-declinate. Tepals strongly reflexed, (6.5–)8–13 mm long, inner elliptic, 3.5–5 mm wide, outer narrowly elliptic, 2–2.5 mm wide. Filaments scaled, linear, 4–6.5 mm long, insertion dorsal in a pocket. Anthers free, 2.5–3.25 mm long, not versatile, dehiscence lateral. Ovaries 1.5–3 mm long. Capsule (only one seen) 6.5 mm long, 5 mm wide. In flower late August–September. Chromosome number $n = 8$ (*Cruden 1827*).

Echeandia attenuata is known only from seepage areas between 2000 and 2200 m along the Durango-Sinaloa border (Fig. 1). It is distinguished by the long-attenuate leaves, both basal and cauline, smallish, cernuous-declinate flowers with relatively narrow and strongly reflexed tepals, and filaments that are inserted in a pocket, which forces the anthers to extend along the same axis as the filaments. The narrow, strongly reflexed tepals and nonversatile anthers distinguish it from *E. flavescens* (Schultes & Schultes f.) Cruden, a common species of desert grasslands and conifer forests of interior central and northern Mexico.

Paratypes. MEXICO. **Durango:** 2 mi. NE El Paraíso, Sinaloa on road between Villa Unión and El Salto, 7000 ft., 28 Sep. 1953, *Ownbey & Ownbey 1931* (MICH). **Sinaloa:** Ruta 40, K 204, 5 km W El Palmito, 2000 m, 27 Aug. 1970, *Cruden 1827* (NY, US).

7. Echeandia sanmiguelensis Cruden, sp. nov. TYPE: Mexico. Guanajuato: Ruta 49, Km 30–31, ca. 9 km N of San Miguel de Allende, grazed field along road with *Acacia, Opuntia, Agave*, 1950 m, 4 Aug. 1968, *Cruden 1460* (holotype, UC; isotypes, K, MEXU, MO).

Radicibus penariis a cormo 2–3 cm, scapis glabris 45–75 cm altis, foliis basalibus anguste ovatis falcatis 7–13 mm latis, tepalis albis, filamentis squamosis 5–6 mm longis, antheris libris non versatilis.

Storage roots enlarged 2–3 cm from corm, 3–5 cm long. Basal leaves linear, attenuate, falcate, 5–8, 17–33 cm long, 7–13 mm wide, margin ciliate. Scapes glabrous, 45–75 cm high, bearing 0–2(–4) branches. Cauline leaves 0–2, when present, lower aristate, 18–67 mm long. Flowers white, cernuous-declinate. Tepals 11–15 mm long, inner broadly elliptic, 5.5–7 mm wide, outer elliptic, 3–4.5 mm wide. Filaments scaled, linear, 5–6 mm long, insertion dorsal in a pit. Anthers free, 1.5–2.5 mm long, not versatile due to the reflexed anther walls, dehiscence lateral. Ovaries 2.5–3.5 mm long. Styles bent upward below the stigma. Capsules oblong, (8.5–)10–16 mm long, 3.5–6.5 mm wide. In flower late July–August.

This species is known from only three collections possibly representing just one or two populations near San Miguel de Allende (Fig. 1). The two Cruden collections may be from a single large population.

The falcate leaves, white, declinate flowers, and storage roots enlarged close to the corm suggest a relationship with *E. scabrella* (Bentham) Cruden, which has smaller flowers, subglobose capsules, and scabrescent scapes. The few aristate cauline leaves, if present, broader lanceolate leaves, and longer capsules differentiate it from *E. tamaulipensis* Cruden. The white flowers distinguish this species from *E. flavescens*, which occurs in similar habitats. In addition, few individuals of the latter species have storage roots enlarged close to the corm in combination with 5–8 basal leaves that tend to be falcate.

Paratypes. MEXICO. **Guanajuato:** Ruta 49, Km 31–32, ca. 8 km N of San Miguel de Allende, 1950 m, 23 Aug. 1970, *Cruden 1805* (ENCB, F, GH, MICH, NY, UC, US); San Miguel de Allende, 6500 ft., 26 July 1950, *Spivey 177* (UC).

8. Echeandia tamaulipensis Cruden, sp. nov. TYPE: Mexico. Tamaulipas: Papolote de la Mirandena, 3 mi. SSW of headquarters, Loreto Ranch, 24°20′N, 98°W, 16 Sep. 1960, *Johnston & Crutchfield 5550* (holotype, MEXU; isotypes, LL, MICH, TEX, UC).

Radicibus penariis a cormo (1–)3–6 cm clavatis, foliis basalibus linearibus 4–12 mm latis, scapis glabris vel scabris, tepalis albis, filamentis pauci squamosis 4.5–6.5 mm longis, antheris libris non versatilis dehiscens lateralibus.

Storage roots enlarged (1–)3–6 cm from corm, long tapered, 3–9 cm long. Basal leaves 3–7, linear, 20–65 cm long, denticulate to short ciliate, 4–12 mm wide. Scape glabrous or scabrescent, 40–60 cm high, bearing 0–2(–3) branches. Cauline leaves 1–4, reduced to bracts. Flowers white, probably cernuous-declinate. Tepals 10–15 mm long, inner broadly elliptic, 4.5–5 mm wide, outer narrowly elliptic to elliptic, 1.5–3.5 mm wide. Filaments weakly scaled, linear, 4.5–6.5 mm long, insertion usually dorsal in a deep pit or pocket, if in a shallow pocket, the reflexed anther walls hold the anther on same radius as the filaments. Anthers free, 1.7–2.5 mm long, not versatile, dehiscence lateral. Ovaries 2.5–3.5 mm long. Capsules broadly oblong to oblong, 8–11 mm long, 5–5.5 mm wide. In flower September–October.

This white-flowered species is known only from the coastal plain of central and southern Tamaulipas (Fig. 1). It might be confused with either *E. flavescens* or *E. chandleri* (Greenman & Thompson) M. C. Johnston, which both have yellow flowers. The former occurs at much higher elevations and has versatile anthers, while the latter has somewhat larger flowers and strongly scaled filaments. The Mexican collections of *E. chandleri* are from higher elevations (900–1000 m) or from northern Tamaulipas.

Paratypes. MEXICO. **Tamaulipas:** S Lomas del Real, 7 mi. N of Altamira, 27 Oct. 1959, *Johnston & Graham 4540* (MICH, TEX); Sierra de Tamaulipas, ca. 40 km NNW Aldama, ca. 23°14′N, 98°10′W, above Juan Tomás, E Las Yucas, 13 Oct. 1957, *Dressler 2384* (GH, MO); 15 mi. from Tampico on the Mante highway, 27 Sep. 1959, *Graham & Johnston 4087* (MEXU, MICH, TEX).

The following species are included in subgenus *Mscavea.*

9. Echeandia atoyacana Cruden, sp. nov. TYPE: Mexico. Guerrero: rocky outcrop with *Matalea, Commelina, Cnidosculus,* Ruta 95, Km 103–104, ca. 31 Km S bridge over Río Papagayo, 300 m, 4 Aug. 1970, *Cruden 1734* (holotype, UC; isotypes, F, GH, K, MEXU, MO).

Radicibus penariis a cormo 3–8 cm, foliis basalibus 6–12 ovatis 8–28 mm latis marginibus integris ad denticulatis, scapis scabris ad 1 m altis, foliis caulibus 2–4, tepalis albis, filamentis linearibus glabris flexus intro super ovarium, antheris connatis.

Storage roots 3–8 cm from corm, 1–2 cm long. Basal leaves 6–12, narrowly ovate to narrowly elliptic, (12–)23–52 cm long, (8–)13–28 mm wide, margins entire to denticulate or serrulate. Scapes scabrous, 33–97 cm high, bearing (0–)1–4(–9) branches. Cauline leaves 2–4, reduced to bracts. Flowers white, nutant, opening in early afternoon. Tepals narrowly elliptic, 6.5–9 mm long to 1 mm wide. Filaments smooth, linear, bent or pinched in above ovary, 2.5–3.3 mm long, insertion basal or nearly so. Anthers connate, 3–5 mm long, the cones strongly tapered. Ovaries 1–2 mm long. Capsules globose, 4–6.5 mm long. In flower July–September. Chromosome number $n = 16$ (*Cruden 1732, 1733, 1734*).

This tetraploid species is known only from Guerrero and adjacent México between 250 and 650 m (Fig. 2). The combination of small flowers, short, strongly tapered anther cones, small capsules, broad basal leaves, and pubescent scapes is unique in subgenus *Mscavea.*

The specific epithet recognizes the town of Atoyac de Alvarez and the Río Atoyac in whose valley I first collected this species.

Paratypes. MEXICO. **Guerrero:** ca. 9.5 km N Atoyac, road to San Vincente and Puerto de Gallo, 300 m, 3 Aug. 1970, *Cruden 1732* (ENCB, K, UC); ca. 6 km N Atoyac, 260 m, 3 Aug. 1970, *Cruden 1733* (MEXU, MO, NY, UC, US, WIS); Dist. Galeana, Atoyac, 25–300 m, 10 Aug. 1939, *Hinton et al. 14526* (ARIZ, GH, LL (2), MO, NY, US); 23 km N Ruta 200 (coast road) on road to Ciudad Altamirano, 500 m, 26 Sep. 1983, *Anderson 12816* (MICH). **México:** Palmar, Dist. Temascaltepec, [650 m], 21 July 1934, *Hinton et al. 6321* (GH, K, NY, US).

10. Echeandia elegans Cruden, sp. nov. TYPE: Mexico. Guerrero: oak woodland, with *Cosmos, Sessilanthera, Commelina, Calochortus, Agave,* ca. 15 km SW Xochipala, road to Puerto de Gallo, 1950 m, 21 Sep. 1973, *Cruden 2096* (holotype, UC; isotypes, ENCB, F, GH, K, MEXU, MO, NY, US).

Radicibus penariis a cormo 2–6 cm, foliis basalibus 5–8 anguste linearibus ad anguste obovatis 7–18 mm latis

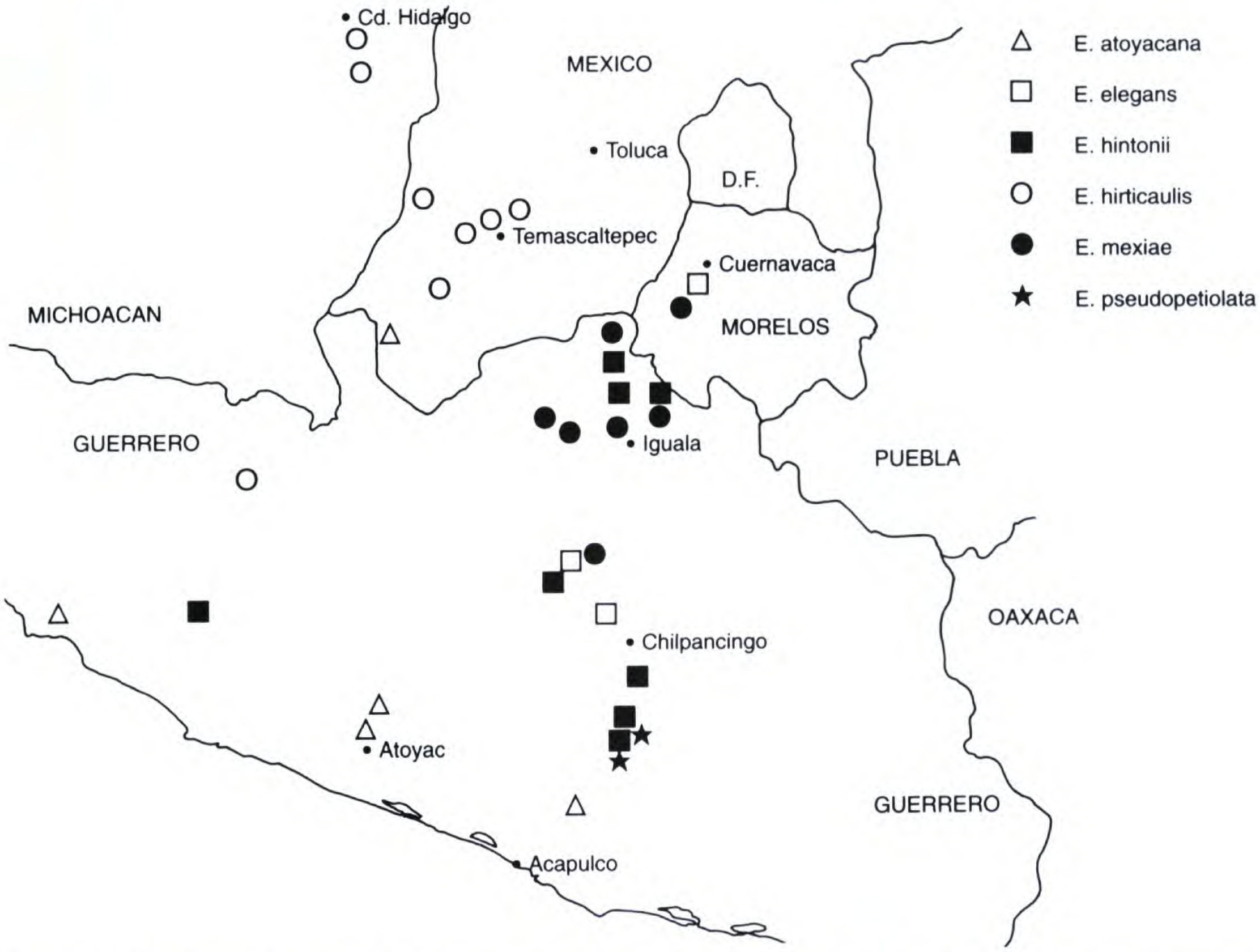

Figure 2. Distributional ranges of six new species in subgenus *Mscavea*. The names of the states are capitalized and towns and cities are indicated by a small solid circle. The distributional range of *Echeandia nayaritensis* is not illustrated.

marginibus intergris ad breviciliatis, scapis glabris glaucis, foliis caulibus 4–10, tepalis albis 13–20 mm longis, filamentis clavatis squamosis, antheris connatis 8–11.5 mm longis.

Storage roots 2–6 cm from corm, 1.5–2.5 cm long. Basal leaves 5–8, narrowly linear to narrowly obovate, 20–70 cm long, 7–14(–18) mm wide, margins entire to short ciliate. Scape glabrous, glaucous, 0.7–1.5 m high, bearing 0–9 branches. Cauline leaves 4–10, lowest 9–30 cm long, others reduced upward. Flowers white, nutant, opening in late morning. Tepals narrowly elliptic, 13–20 mm long, inner 3.5–5 mm wide, outer 1.5–3 mm wide. Filaments scaled, clavate, 3.5–7.5 mm long, insertion dorsal in a pocket. Anthers connate, 8–11.5 mm long, 1.5–2 times the length of the filaments, the cones usually strongly tapered, rarely weakly so. Ovaries 2.5–4 mm long. Capsules broadly oblong, 8–9.5 mm long, 5–5.5 mm wide. In flower September–October. Chromosome number $n = 8$ (*Cruden 2096, 2173*).

This is a species of oak woodlands between 1900 and 2300 m in Guerrero and adjacent Morelos (Fig. 2). The available material includes two types. The specimens from Temisco have 5–9 branches, anther cones that are weakly tapered, and may have large storage roots. The material from central Guerrero has 0–3 branches, strongly tapered anther cones, and quite slender storage roots. Vegetatively, this species is difficult to distinguish from *E. hintonii*. Relative to the latter species, *E. elegans* has longer tepals and anthers, an anther cone that is usually twice the length of the filaments, and smooth lower leaf surfaces.

Paratypes. MEXICO. **Guerrero:** 14 mi. from Mex 95 on road to Chichihualco, 26 Oct. 1970, *Graham 1226* (MICH). **Morelos:** Ruta 95 (libre) in Temisco, ca. 9 km S Cuernavaca, 22 Sep. 1974, *Cruden 2173* (GH, K, MEXU, MICH, UC).

11. Echeandia hintonii Cruden, sp. nov. TYPE: Mexico. Guerrero: on steep, damp bank with *Blechnum, Adiantum, Oxalis, Cuphea,* in pine-oak woods, Ruta 95, near Agua de Obispo, ca. 39 km S Chilpancingo, 780 m, 2 Aug. 1970, *Cruden 1729* (holotype, UC; isotypes, ENCB, F, GH, K, MEXU, MO, NY, US, WIS).

Radicibus penariis a cormo 4–8 cm, foliis basalibus 3–5(–8) anguste linearibus ad anguste obovatis 5–20 mm latis, scapis glabris vel scabris, foliis caulibus 1–4(–5), tepalis albis 10–13 mm longis, filamentis clavatis squamosis, antheris connatis 4.5–8 mm longis, conis antherarum ad apicem valde contractis.

Storage roots 4–8 cm from corm, 1–2 cm long. Basal leaves 3–5(–8), narrowly linear to narrowly obovate, in many minutely papillate between the veins on lower surface, 13–56 cm long, 5–20 mm wide, margin entire to denticulate. Scapes glabrous or scabrescent, 37–111 cm high, bearing 0–4 branches. Cauline leaves 1–4(–5), the lower 8.5–28 cm long. Flowers white, nutant, opening in late morning. Tepals narrowly elliptic, 10–13 mm long, inner 3.5–4.5 mm wide, outer 1.5–2 mm wide. Filaments scaled, clavate, sometimes narrowly so, 3.5–5 mm long, insertion basal or dorsal in a pocket. Anthers connate, 4.5–8 mm long, the cones strongly tapered, 1–1.7 times the length of the filaments. Ovaries 2–4 mm long. Capsules broadly oblong, 7–9 mm long, 4–5 mm wide. In flower late June–October. Chromosome number $n = 8$ (*Cruden 1723, 1729, 2102*).

Among species in subgenus *Mscavea* with narrow leaves and scaled filaments, this species is distinguished by its slender, well-removed storage roots. All collections are from oak and pine-oak woods in central and north-central Guerrero between 750 and 2350 m (Fig. 2). Specimens with pubescent scapes are a little larger and have fewer cauline leaves and tiny papillae on the lower surfaces of the basal and cauline leaves. There is no geographic pattern to plants with glabrous and pubescent scapes, and in the vicinity of Agua de Obispo the leaves of specimens with both types of scapes were papillate; thus, there is little reason to recognize the variation formally.

This species honors George B. Hinton whose collections from Guerrero have added considerably to our understanding of the region's *Echeandia*.

Paratypes. MEXICO. **Guerrero:** Pasión, Dist. Montes de Oca, 1000 m, 5 Oct. 1937, *Hinton et al. 10763* (GH, LL, NY, US); Ruta 95, ca. 17 km S Chilpancingo, ca. 1250 m, 2 Aug. 1970, *Cruden 1723* (ENCB, GH, K, UC); 61 mi. NE Acapulco, Aug. 1965, *Irving 230* (TEX); ca. 29 km SW of Xochipala, on road to Puerto de Gallo, 2225 m, 22 Sep. 1973, *Cruden 2102* (MEXU, UC); 65.3 km from the "desviación" of the Acapulco–México highway, 2350 m, 21 Oct. 1986, *Romo 321* (MEXU); Agua de Obispo, 1100 m, 10 Oct. 1986, *Palomino, Romo & Kenton 308* (MEXU); Taxco, 12 July 1932, *Abbott 239* (GH), 23 July 1936, *Abbott 160* (GH); N Taxco, 25 June 1935, *Clark 7238* (NY).

12. Echeandia hirticaulis Cruden, sp. nov. TYPE: Mexico. México: Ruta 130, ca. 2.5 km NE Temascaltepec, oak woods with *Tigridia, Sphenostigma, Cuphea, Eryngium*, 1750 m, 11 Sep. 1971, *Cruden 1967* (holotype, UC; isotypes, ENCB, GH, K, MEXU, MO).

Radicibus penariis a cormo 2–4 cm, foliis basalibus anguste ovatis (8–)15–42 mm latis marginibus longiciliatis, scapis plerumque hirsutis in dimidio inferiore, foliis caulibus 3–4, tepalis albis, filamentis squamosis, antheris connatis.

Storage roots 2–4 cm from corm, 1–2 cm long. Basal leaves 4–8, narrowly ovate, (17–)25–55 cm long, (8–)15–42 mm wide, margins long ciliate and usually undulate. Scapes usually hirsute on the lower half, hairs long and flat, 0.2–0.5 mm long, rarely with just a few hairs above the lowest cauline leaf, 0.6–1.3 m high, (3–)5–9-branched, which in large individuals bear secondary branches. Cauline leaves 3–4, lowest 12–54 cm long, others reduced to bracts, long ciliate. Flowers white, nutant, opening in late morning. Tepals narrowly elliptic, 12–17 mm long, 1–2 mm wide. Filaments scaled, clavate, (3–)3.5–5.5 mm long, insertion dorsal in a pocket. Anthers connate, (6–)7.5–10.5 mm long, the cones strongly tapered, usually twice the length of the filaments. Ovaries 1–3 mm long. Capsules broadly oblong, 6–8 mm long, 4–5 mm wide. In flower August–mid October. Chromosome number $n = 8$ (*Cruden 1967, 1970*).

This species is found between 1000 and 2000 m in openings in oak and pine-oak woods in a small region in western México, eastern Michoacán, and northern Guerrero (Fig. 2). The closest relative of this species may be *E. macrophylla* Rose, which is found between 1000 and 1500 m in San Luis Potosí and Tamaulipas. Other robust species in the Sierra Volcánica Transversal have straight, smooth filaments, numerous cauline leaves, and/or flowers that open in the afternoon. The specific epithet describes the hirsute scapes.

Paratypes. MEXICO. **Guerrero:** Manchón, Dist. Mina, 27 Sep. 1936, *Hinton et al. 9596* (GH, K, LL, NY, US). **México:** between Zitácuaro and Las Anonas, Dist. Zitácuaro, 1600 m, 23 Aug. 1938, *Hinton et al. 13146* (GH, K, LL, NY, US); Ixtapan, Dist. Temascaltepec, 1000 m, 5 Aug. 1932, *Hinton 1263* (GH, K, MICH, NY, UC, US); Carboneras, Dist. Temascaltepec, 2030 m, 27 Sep. 1932, *Hinton 1852* (K); 4.5 mi. NE Temascaltepec, 1850 m, 11 Oct. 1966, *Anderson & Laskowski 3934* (ENCB, MICH); 5 km S Temascaltepec, 1900 m, 3 Sep. 1965, *Roe, Roe, Mori & Rzedowski 1707* (WIS); road to Tingambato, E San Nicholás, 1600 m, 20 Sep. 1974, *Cruden 2169* (UC). **Michoacán:** 7 mi. E Hidalgo, 20 Aug. 1953, *Manning & Manning 531089* (GH); Ruta 15, near Km 116,

ca. 9.5 km S Tuxpan, 2000 m, 11 Sep. 1971, *Cruden 1970* (ENCB, GH, K, UC).

13. Echeandia mexiae Cruden, sp. nov. TYPE: Mexico. Guerrero: tropical deciduous with palmetto palm, *Salvia*, *Dahlia*, *Bursera*, 4.5 km SW Xochipala, 1280 m, 21 Sep. 1973, *Cruden 2094* (holotype, UC, isotypes, F, GH, K, MEXU, MO, US).

Radicibus penariis a cormo 3–9 cm, foliis basalibus 3–5 anguste obovatis (10–)15–40 mm latis marginibus breviciliatis, scapis scabris 1–1.3 m altis, foliis caulibus 6–15, tepalis albis, filamentis linearibus glabris, antheris connatis.

Storage roots enlarged 3–9 cm from the corm, 1.5–3 cm long. Basal leaves 3–5, narrowly obovate, 37–45 cm long, (10–)15–40 mm wide, margin short ciliate. Scape scabrous throughout, 1–1.3 m high, (3–)5–14-branched, some nodes with two branches and some branches bearing a secondary branch. Cauline leaves 6–15, reduced to bracts. Flowers white, nutant, opening in late afternoon. Tepals narrowly elliptic, 9–13 mm long, inner 2–3 mm wide, outer 1–2 mm wide. Filaments smooth, linear, 2–3.5 mm long, insertion basal or nearly so. Anthers connate, 4.5–6.5 mm long, the cones strongly tapered. Ovaries 1.7–2.5 mm long. Capsules broadly oblong, 5–8 mm long, 4–5 mm wide. In flower August–October. Chromosome number $n = 8$ (*Cruden 2086, 2087, 2088, 2094, 2172*).

All collections of this species were made in north-central Guerrero and adjacent Morelos (Fig. 2) between 400 and 1500 m in relatively dry habitats, including deciduous thorn scrub. Several collections are from limestone-derived soils. The numerous cauline leaves and smooth filaments suggest a relationship with the widespread *E. ramosissima* (Presl) Cruden of western Mexico. Scapes of the latter are usually glabrous, rarely scabrescent near the base, and the basal leaves are usually narrower.

The specific epithet honors Ynes Mexia, who collected extensively in Mexico and South America in the 1920s and 1930s.

Paratypes. MEXICO. **Guerrero:** Cañon de la Mano Negra, near Iguala, 11 Aug. 1905, *Rose, Painter & Rose 9328 (US)*; Ruta 95D, Km 63–64, ca. 12 km S Morelos state line, 1070 m, 20 Sep. 1973, *Cruden 2086* (ENCB, GH, K, TEX, UC, WIS); Ruta 51, ca. 22 km W Iguala, 915 m, 20 Sep. 1973, *Cruden 2087* (ENCB, F, GH, K, UC); ca. 35 km W Iguala, 1500 m, 21 Sep. 1973, *Cruden 2088* (UC); ca. 36 km W of Iguala, 1000 m, 30 Sep. 1982, *Iltis, Benz & Burd 28634* (IA, WIS); Ruta 55, Km 118–119, ca. 30 km N Taxco, 1150 m, 21 Sep. 1974, *Cruden 2172* (MEXU, MO, NY, UC); Temisco, top of barranca Limo, 380–400 m, 30 Oct. 1937, *Mexia 8711* (ARIZ, F, GH, K, MO, NY, U, UC, US). **Morelos:** vicinity of Cuernavaca, 1905, *Lemmon & Lemmon s.n.* (UC).

14. Echeandia nayaritensis Cruden, sp. nov. TYPE: Mexico. Nayarit: Mpio. Ruiz, 1–3 km W El Venado, road from Ruiz to Jesús María, 60 m, 9 Aug. 1980, *Breedlove & Almeda 45284* (holotype, CAS).

Radicibus penariis a cormo 0.5–2 cm, foliis basalibus anguste linearibus, scapis glabris, tepalis albis 12–19 mm longis, filamentis fusiformis squamosis, antheris connatis 6–11 mm longis, conis antherarum filamentis duplo longioribus.

Storage roots enlarged 0.5–2 cm from corm, 1–4 cm long. Basal leaves 3–10, narrowly linear, 16–38 cm long, (2–)4–8 mm wide, entire, sometimes falcate. Scapes glabrous, 41–58 cm high, bearing 0–3 branches. Cauline leaves 1–2, bract-like. Flowers white, nutant. Tepals narrowly elliptic, 12–19 mm long, inner 2–3 mm wide, outer 1–2 mm wide. Filaments scaled, fusiform, 3.0–4.5 mm long, insertion basal or nearly so. Anthers connate, (6–)7.5–11 mm long, the cones weakly tapered, widest in the middle or parallel-sided in lower half, twice the length of the filaments. Ovaries 1–2 mm long. Capsules broadly oblong, 5–7 mm long, 4.5–5.5 mm wide. In flower July–August.

This little-collected species is endemic to the coastal lowlands of northern Nayarit and adjacent Sinaloa, where it occurs in open areas and palm savanna below 400 m. The long tepals, long anthers, and storage roots enlarged and clustered close to the corm suggest a relationship with *E. mcvaughii* Cruden, which occurs at higher elevations in Nayarit, Jalisco, and western Michoacán. The scape of the latter species is usually pubescent, and the basal leaves are usually more than 10 mm wide and falcate.

Paratypes. MEXICO. **Nayarit:** 26.8 mi. S of Sinaloa state line, 200 ft., 24 July 1975, *Dunn, LeDoux & Wallace 21850* (LL). **Sinaloa:** La Jarretadera, ca. 149 km N Tepic, 19 Aug. 1988, *Walker s.n.* (K, MEXU, MO, UC).

15. Echeandia pseudopetiolata Cruden, sp. nov. TYPE: Mexico. Guerrero: Ruta 95, Km 44–45, near El Rincón, ca. 44.5 km S Chilpancingo, 600 m, 2 Aug. 1970, *Cruden 1731* (holotype, UC).

Radicibus penariis a cormo 1–3.5 cm, foliis basalibus 4–6, 43–56 cm longis dimidio inferiore anguste linearis 3–5 mm latis dimidio superiore magnopere expansis ovatis ad ellipticis (21–)26–35(–45) mm latis, scapis glabris, foliis caulibus 2–4, tepalis albis, filamentis linearibus paucisquamosis, antheris connatis.

Storage roots 1–3.5 cm from corm, 1–1.5 cm long. Basal leaves 4–6, oblanceolate, 43–56 cm long, lower half narrowly linear, 3–5 mm wide, expanded in the upper half into a broad, ovate to elliptical blade, (21–)26–35(–45) mm wide, margins short ciliate to ciliate. Scape glabrous, 88–106 cm high, up to 7 branches. Cauline leaves 2–4, the lowest 12.5–36 cm long, resembling the basal leaves, but without the "petiole." Flowers white, nutant, opening in the afternoon. Tepals narrowly elliptic, 6–9 mm long, 1–1.5 mm wide. Filaments weakly scaled, linear, sometimes wrinkled and/or twisted, 3–4 mm long, insertion dorsal in a pocket. Anthers connate, 4–5.5 mm long, the cones strongly tapered. Ovaries 1–2 mm long. Capsules not seen. In flower late July–August. Chromosome number $n = 8$ (*Cruden 1731*).

This species is known from a few collections in south-central Guerrero between 600 and 1100 m along the highway from Acapulco to Iguala (Fig. 2). It occurs in pine-oak and oak woods, as well as disturbed roadsides. The specific epithet describes the distinctive pseudopetiolate basal leaves.

Paratypes. MEXICO. **Guerrero:** Agua de Obispo, 1100 m, 12 Aug. 1962, *Kruse 796* (ENCB); 1000 m, 8 Aug. 1972, *Boege 2441* (MEXU); Hwy. to Acapulco, Km 338, 3 km beyond Acahuizotla, 3000 ft., 20 Aug. 1948, *Moore & Wood 4675* (F, GH, MICH, UC, US).

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Austral Hepaticae 29. More New Taxa and Combinations in *Telaranea* (Lepidoziaceae) and a New Name for *Frullania caledonica* (Schuster) Schuster (Frullaniaceae) from New Caledonia

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ABSTRACT. *Telaranea consobrina, T. fragilis,* and *T. palmata,* new species from Australasia, are described and illustrated. *Telaranea clatritexta* (Stephani) Engel & Merrill and *T. quadricilia* (Stephani) Engel & Merrill of Australasia and *T. fernandeziensis* (Stephani) Engel & Merrill from Juan Fernández are new combinations. *Frullania neocaledonica* of New Caledonia is proposed as a new name for *Frullania caledonica* (Schuster) Schuster, an illegitimate name.

The following new taxa and new combinations, together with those previously published (Engel & Merrill, 1995), are the result of a phylogenetic study of the genus *Telaranea,* which is currently in preparation by the authors. The names are here published separately to make them immediately available for use. Studies on Australasian Hepaticae have also revealed a nomenclatural change required in the genus *Frullania.*

Telaranea clatritexta (Stephani) Engel & Merrill, comb. nov. Basionym: *Lepidozia clatritexta* Stephani, Spec. Hep. 3: 583. 1909. TYPE: Australia. Western Australia: Swan River, *Drummond,* ex Herb. Kew (G).

Lepidozia complanata Herzog, Memoranda Soc. Fauna Fl. Fenn. 27(1950–1951): 92. fig. 39. 1952. Syn. nov. *Telaranea complanata* (Herzog) Engel & Merrill, Phytologia 79: 251. 1995 [June 1996]. TYPE: Australia. Western Australia: without specific loc., *Goebel* (holotype, not seen).

In a previous paper (Engel & Merrill, 1995), we published the combination *Telaranea complanata* (Herzog) Engel & Merrill. Further studies have revealed that *Lepidozia clatritexta* Stephani is the same taxon, and a transfer to *Telaranea* is therefore required.

Telaranea consobrina Engel & Merrill, sp. nov. TYPE: Tasmania. Eastern slope of Black Bluff just below summit, S of Burnie, 1250 m, 21 Mar. 1977, *Engel 15799* (holotype, F; isotype, HO). Figure 1.

Species nova *T. meridianae* affinis disco folii basin versus 8 cellulis lato, lobis angustioribus, amphigastriis latioribus brevioribusque, hyalodermate conspicuo differt.

Plants soft and flexuous, ascending to suberect, pale green, medium in size, to 6 mm wide, including branches. Branching rather regularly 1-pinnate, the branches of the *Frullania*-type, at times becoming flagelliform; first branch underleaf undivided (very rarely bilobed), broadly acuminate to lanceolate. Ventral-intercalary branches not seen. Stems with cortical cells distinctly differentiated, thin-walled, in 13–14 rows; cortical cells in section slightly to distinctly larger than the numerous (49–53) medullary cells. Leaves on main shoot obliquely spreading, contiguous, the disc plane or weakly convex, the lobes ventrally decurved, the insertion distinctly incubous, the disc broader than high; leaves 475–600 μm wide × 440–525 μm long, the leaves 4(5)-lobed to 0.4–0.5, the lobes straight to moderately divergent. Lobes narrowly acute to acuminate, 4–5 cells wide at base, often 4 cells wide in basal sector, then biseriate for 2–3 tiers, terminating in a short uniseriate row of 2–3 cells (or sporadically a single cell or 2 laterally juxtaposed cells); lobe cells ± isodiametric to short rectangular, thin-walled. Leaf disc somewhat asymmetrically cuneate, the disc (5)6–7(8) cells high (from median sinus base to leaf base), 13–16 cells wide in distal portion narrowing to 8(9) cells wide in basal portion. Cells of disc thin-walled, median cells short rectangular, 24–38(42) μm wide × 42–49 μm long, the cells in ± irregular rows; cuticle smooth. Underleaves somewhat smaller than leaves, 1.7–2.3× stem width, 4(5)-lobed to 0.4–0.45, the lobes narrowly acute, 3–4 cells wide at base and biseriate for 1–2 tiers, ending in a uniseriate row of 2–3 short cells; disc symmetrically broadly cuneate (wider than high), 4–5 cells high (median sinus), 14–18 cells wide. Asexual reproduction lacking.

Androecia and gynoecia not seen.

Taxonomy. This species strongly resembles *T. meridiana* of New Zealand, with broad, almost lon-

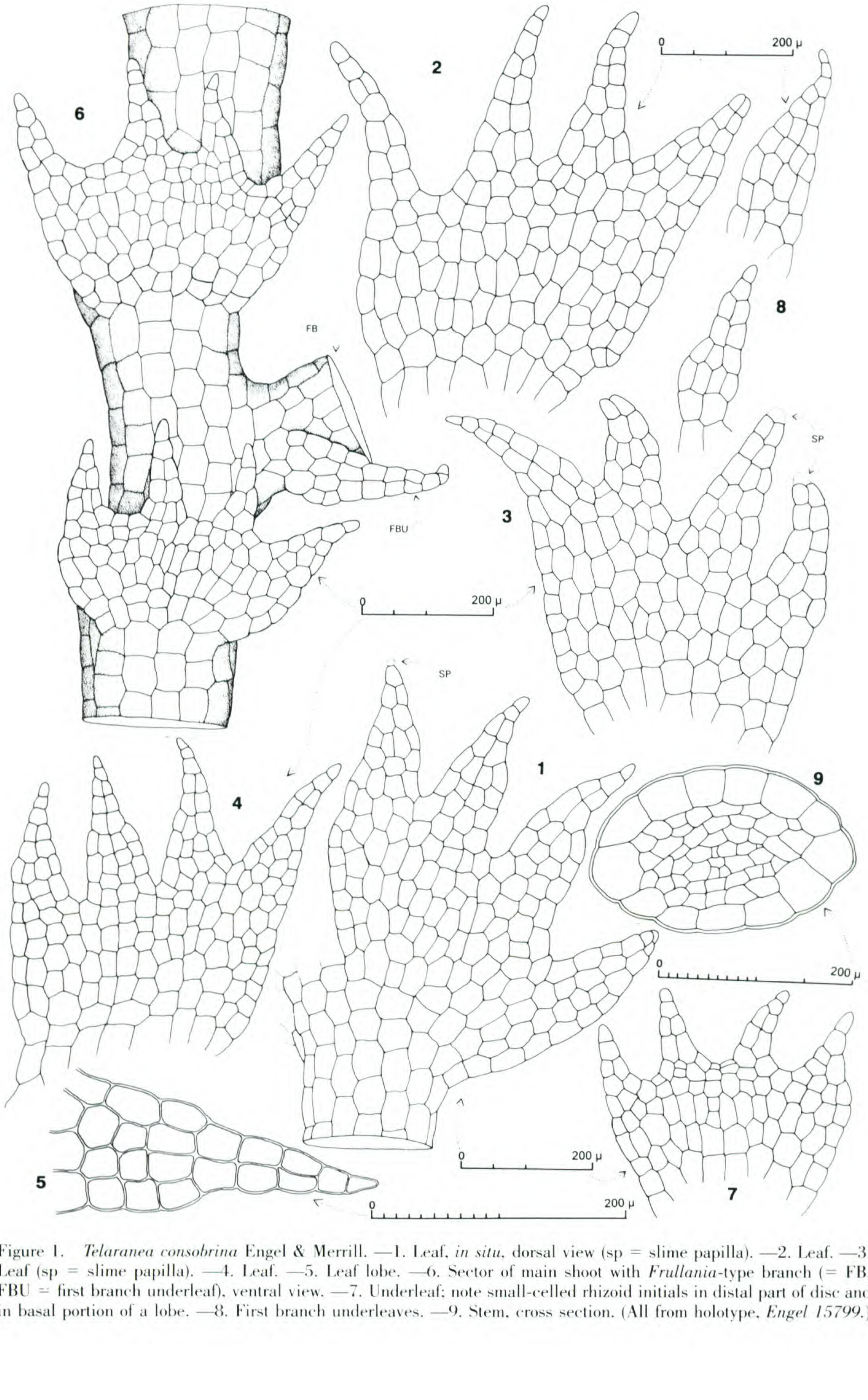

Figure 1. *Telaranea consobrina* Engel & Merrill. —1. Leaf, *in situ*, dorsal view (sp = slime papilla). —2. Leaf. —3. Leaf (sp = slime papilla). —4. Leaf. —5. Leaf lobe. —6. Sector of main shoot with *Frullania*-type branch (= FB; FBU = first branch underleaf), ventral view. —7. Underleaf; note small-celled rhizoid initials in distal part of disc and in basal portion of a lobe. —8. First branch underleaves. —9. Stem, cross section. (All from holotype, *Engel 15799*.)

gitudinally inserted leaves and ventrally decurved leaf lobes. It differs most notably in the shape of the leaf disc, which narrows to 8 cells wide at the insertion (Fig. 1: 1–4) vs. 14–16 cells wide in *T. meridiana*, and in the narrower lobes, which are only 4–5 cells wide at base, and as many as 6(8) cells wide in *T. meridiana*. The underleaves of the Tasmanian plants are larger, roughly 2× the width of the stem (Fig. 1: 6) (vs. 1.2× the stem diameter in *T. meridiana*), and somewhat shorter. As in other *Telaranea* species, the stem cortical cells are few in number and form a conspicuous hyaloderm (Fig. 1: 9).

The epithet *consobrina* ("cousin") refers to the evident relationship of this Tasmanian species to *T. meridiana* (Hodgson) Hodgson of New Zealand.

Distribution and ecology. The species is known from two stations in Tasmania, occurring in the crevice of a dripping cliff face in an area with alpine vegetation (type locality) and in a creek bed within an area having a mosaic of cushion plants, *Diselma*, scattered pools, and small streams.

Additional specimen examined. TASMANIA. Cradle Mtn.-Lake St. Clair Natl. Park, Plateau Creek area, between Cradle Plateau and Marions Lookout, NNW of Cradle Mtn., 1250 m, *Engel 13960* (F).

Telaranea fernandeziensis (Stephani) Engel & Merrill, comb. nov. Basionym: *Lepidozia fernandeziensis* Stephani, Kongl. Svenska Vetenskapsakad. Handl. 46(9): 63. fig. 24e. 1911. TYPE: Juan Fernández. Mas a Tierra, El Yunque, 24 Aug. 1908, *Skottsberg* (lectotype, designated by Solari (1987), S).

We have examined the lectotype of *Lepidozia fernandeziensis*, and find that this plant belongs to the complex of *Telaranea* species that includes *T. tetradactyla* (Hooker f. & Taylor) Hodgson.

Telaranea fragilis Engel & Merrill, sp. nov. TYPE: New Zealand. North Island: North Auckland Prov., NE Waitakere Ranges, Swanson University Reserve, Tram Valley Road, 95 m, *Engel 20465* (holotype, F; isotype, CHR). Figure 2.

Ex affinitate *T. centipedis* foliis fragilibus, disco lateribus parallelis ubique 8 cellulis lato, et serie uniseriata lobi cellulis angustioribus longioribusque distinguenda.

Plants delicate, flexuous, prostrate, glaucous, whitish to bluish green, dull and distinctly water repellent; shoots medium in size, to ca. 1 cm wide, including branches. Branching loosely and irregularly 1-pinnate, the branches of the *Frullania*-type, rarely becoming flagelliform; first branch underleaf undivided, subulate. Ventral-intercalary branches present. Stems with cortical cells distinctly differentiated, in 9–12 rows, thin-walled; medullary cells ca. 16. Leaves fragile, erose-truncate (the lobes all or mostly broken off, and often the distal tiers of disc cells missing), widely spreading, at times nearly at right angles to stem, distant to loosely imbricate, plane, strongly horizontally oriented, the insertion distinctly incubous; leaves 260–290 μm wide, the fragmented leaf 280–390 μm long (including basal cell of lobe), 465–505 μm long with lobes, leaves subsymmetric, 4-lobed to ca. 0.4, the lobes ± parallel with disc margins or only slightly divergent. Lobes (when present) subcaudate, 2 cells broad at base, terminating in a uniseriate row of 6–7 cells; lobe cells thin-walled, the distal cells of uniseriate row slender, ± elongate. Leaf disc ± symmetrically quadrate to subrectangular, 5–6(7) cells long (from median sinus base to leaf base), mostly 8 cells wide throughout; margins ± straight to weakly arched. Cells of disc in regular longitudinal rows, thin-walled but firm to moderately thick-walled; median disc cells large, subquadrate, 33–45 μm wide, 40–52 μm long; cuticle a finely granular and faintly striate coating. Underleaves much smaller than leaves, 4-lobed to 0.75–0.85, the lobes ciliiform, the cells of uniseriate row 3–4, elongated, thin-walled; disc abbreviated, 2 cells high, 8 cells wide. Asexual reproduction evidently by fragmentation of leaf lobes and disc.

Androecia and gynoecia not seen.

Taxonomy. Hodgson (1956: 606) observed that the leaves of this species "present a curious appearance, in that the apices are either crenulate with protruding cells of the discus, or with 1 or 2 segments showing as reduced to one roundly quadrate cell, sitting as it were on 2 terminal cells of the lengthwise rows," which aptly describes the leaves of this species (Fig. 2: 7, 10). It is likely that detached lobe and disc cells function as gemmae. Hodgson (1956) cited several populations with these characteristics, and included them under the name *Lepidozia centipes* Taylor.

Telaranea fragilis resembles *T. centipes* in being dull, glaucous, and water-repellent.

Distribution and ecology. Known only from a few scattered sites in North Auckland Province, New Zealand. The species occurs on moist, clayey banks or at times over rock in lowland forests. The type occurred on a vertical clayey bank above a small stream in an old *Kunzea* forest with *Agathis* and (common) *Phyllocladus trichomanoides* Don.

Additional specimen examined. NEW ZEALAND.

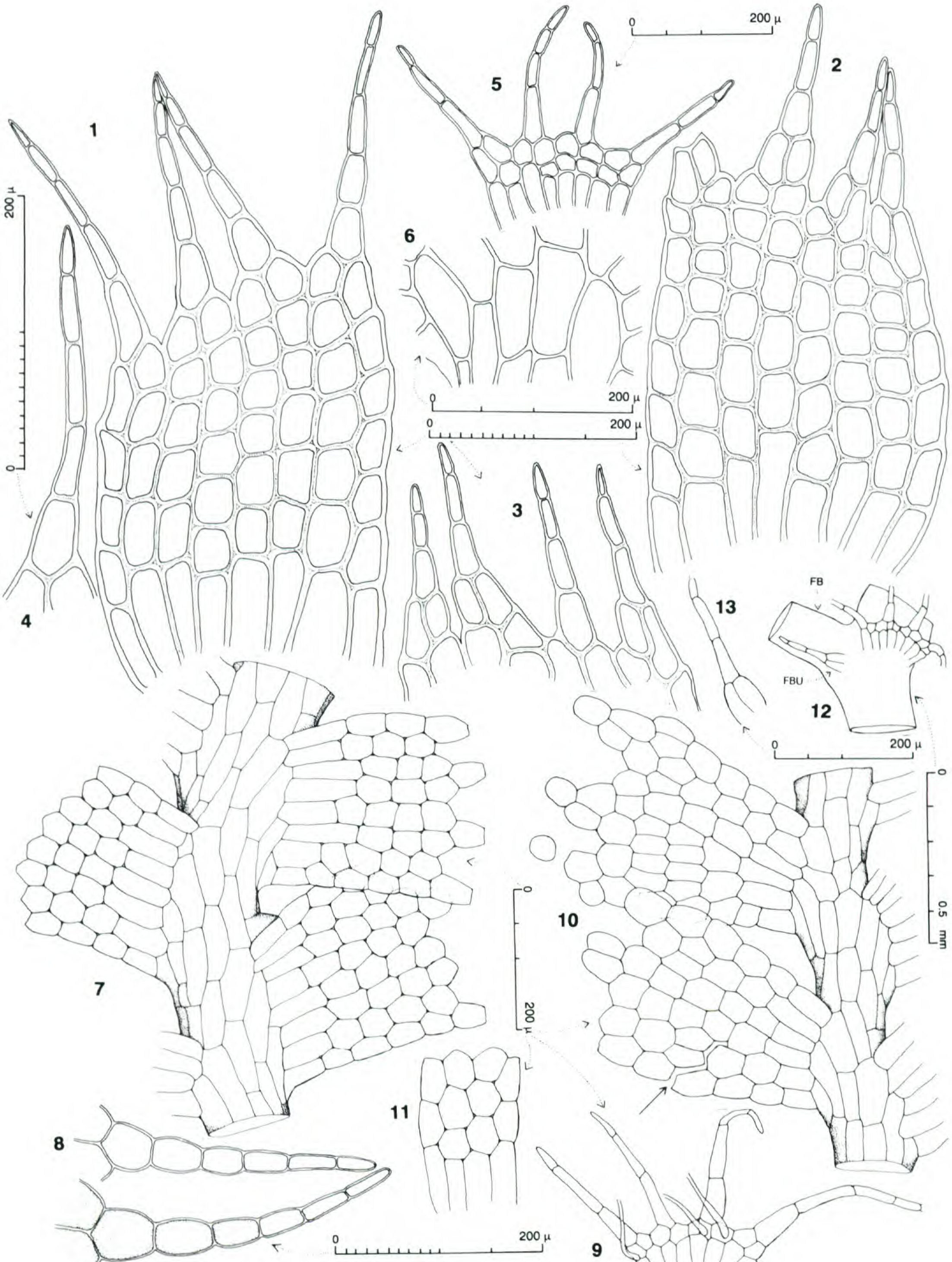

Figure 2. *Telaranea elegans* (Colenso) Engel & Merrill (1–6; see Engel & Merrill, 1995) and *T. fragilis* Engel & Merrill (7–13). —1, 2. Leaves. —3. Distal portion of leaf. —4. Leaf lobe. —5. Underleaf. —6. Stem, surface view. —7. Sector of main shoot, dorsal view. —8. Leaf lobes (cuticle shown in part). —9. Underleaf. —10. Sector of branch showing (top leaf) fragmenting of leaf tip forming a gemmae-like body (at arrow) and (lower leaf) a disc in process of partially breaking away (fracture at arrow). —11. Half-leaf. —12. Branch base (FB = *Frullania*-type branch; FBU = first branch underleaf), the underleaf of main shoot shown in part. —13. First branch underleaf shown in Figure 12. (Figs. 1, 4–6, from type of *T. elegans*, *Winkelmann s.n.*, WELT; 2, 3, from *Engel 17216*, Australia, New South Wales, Morton Natl. Park, Fitzroy Falls; 7–13, from type of *T. fragilis*, *Engel 20465*.)

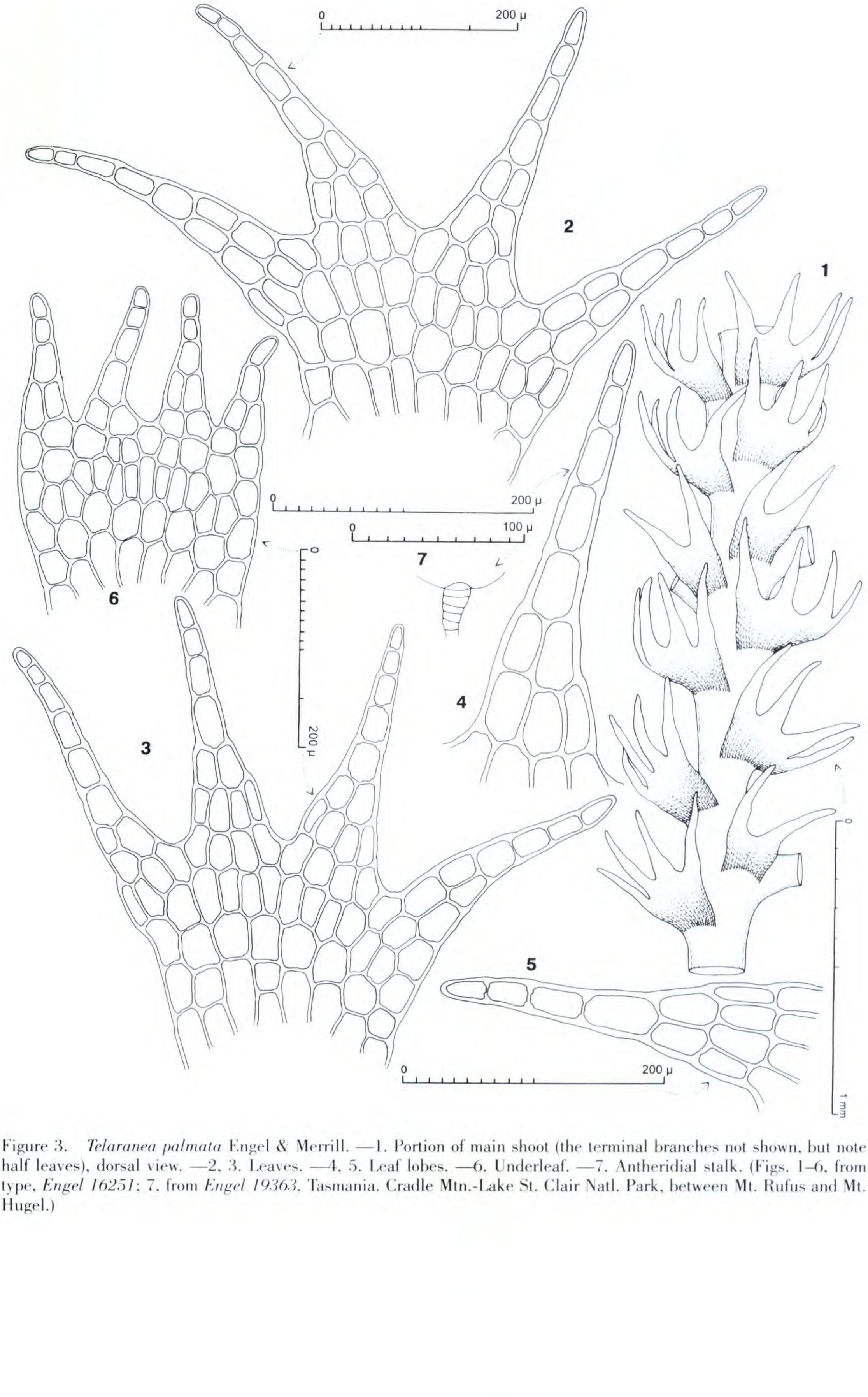

Figure 3. *Telaranea palmata* Engel & Merrill. —1. Portion of main shoot (the terminal branches not shown, but note half leaves), dorsal view. —2, 3. Leaves. —4, 5. Leaf lobes. —6. Underleaf. —7. Antheridial stalk. (Figs. 1–6, from type, *Engel 16251*; 7, from *Engel 19363*, Tasmania. Cradle Mtn.-Lake St. Clair Natl. Park, between Mt. Rufus and Mt. Hugel.)

North Island: North Auckland Prov., Waipoua Forest, *Allison H711* (CHR).

Telaranea quadricilia (Stephani) Engel & Merrill, comb. nov. Basionym: *Lepidozia quadricilia* Stephani, Species Hepaticarum 6: 338. 1922. TYPE: Australia. New South Wales, Clarence, *Verreaux* (G).

Telaranea quadricilia is similar to *T. lindenbergii*, but differs by the incubously inserted leaves, the longer leaf lobes, and the papillose cuticle.

Telaranea palmata Engel & Merrill, sp. nov. TYPE: Tasmania. Ridge SE of Black Bluff near junction of access road to plateau area and road to Devonport gold mines, S-facing slope, S of Burnie, 1000 m, *Engel 16251* (holotype, F; isotype, HO). Figure 3.

Telaranea patentissimae affinis foliis palmato-lobatis, insertione foliorum transversa, disco breviore, serie uniseriate loborum longiore, et cellulis disci atque loborum incrassatis diversa.

Plants with a rather stiff and wiry appearance, yellowish green; shoots small, to 0.6 cm wide, including branches. Branching somewhat irregularly and loosely 1(2)-pinnate, the branches remaining rather short, the branches of the *Frullania*-type, occasionally to frequently flagelliform; first branch underleaf undivided and subulate. Ventral-intercalary branches common. Stems with cortical cells markedly differentiated, in 12 rows; cortical cells in section larger than the numerous (ca. 50) medullary cells. Leaves on main shoot rigid, the disc widely spreading to squarrose, distant to loosely imbricate, moderately concave to hand-like, the lobes erect and incurved, at times subfalcate, the insertion transverse to weakly incubous; leaves 480–665(700) μm wide (measured between tips of lobes) $\times$ 400–510 μm long, moderately asymmetric, $\pm$ equally palmately 4-lobed to ca. 0.6, the lobes often widely divergent. Lobes attenuate to subcaudate, 2–4 cells wide at base (when 4 cells wide sometimes with an additional 3–4-seriate tier), then biseriate for 1(2) tiers, terminating in a uniseriate row of 4–6 cells; lobe cells $\pm$ firm, often distinctly thick-walled. Leaf disc symmetrically to somewhat asymmetrically short cuneate, 4 (rarely 5) cells high (from median sinus base to leaf base), 13–16 cells wide in distal portion, narrowing to 8 cells wide at the insertion. Cells of disc moderately to distinctly thick-walled, the cells in $\pm$ regular tiers, the median and basal disc cells 31–36 μm wide $\times$ 39–48 μm long; cuticle smooth. Underleaves much smaller than leaves, 4-lobed to ca. 0.5 or a little more, the lobes divergent, ciliiform, straight, basically 2 cells wide at the base, the cells of uniseriate portion 3(4), slightly elongated; disc symmetrically subquadrate to weakly cuneate, 3(4) cells high (median sinus); disc 8–11 cells wide in distal portion, 8 cells wide at base. Asexual reproduction lacking.

Androecia and gynoecia not seen.

Taxonomy. This species differs from most *Telaranea* species in the transverse insertion of the leaves (Fig. 3: 1). The leaves of this species are palmately lobed (to 0.6) like those of *T. praenitens* (Lehmann & Lindenberg) Hodgson, hence the name. However, the cuticle of *T. palmata* is smooth vs. distinctly striate papillose in *T. praenitens*.

Distribution and ecology. Endemic to Tasmania, and, for the most part, a subalpine-alpine species, occurring above 1000 m in protected, moist niches. The type is from 1000 m elevation in a mosaic of *Gymnoschoemus* (button grass), subalpine shrubs, *Nothofagus cunninghamii* (Hooker) Oersted, and rocky outcrops.

Additional specimens examined. TASMANIA. Mt. Field Natl. Park, Tarn Shelf, below and E of Rodway Range, 1270 m, *Engel 14358* (F); Cradle Mtn.-Lake St. Clair Natl. Park, Lake St. Clair area, between Mt. Rufus and Mt. Hugel, 1120–1130 m, *Engel 19363* (F).

Frullania neocaledonica Engel, nom. nov. Replaced name: *Frullania caledonica* (Schuster) Schuster, Hep. Anthoc. No. Amer. 5: 34. 1992; non Gottsche ex Stephani, Hedwigia 33: 156. 1894. *Neohattoria caledonica* Schuster, J. Hattori Bot. Lab. 33: 291. 1970. TYPE: New Caledonia. Mt. Mou, *Compton*.

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Simaba docensis, a New Brazilian Species of Simaroubaceae

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ABSTRACT. *Simaba docensis*, a new species of Simaroubaceae, is described and illustrated. Its geographical distribution seems to be restricted to semideciduous forest in the region of the Rio Doce basin, Minas Gerais, southeastern Brazil. Accordingly, it is likely to be a rare endemic and endangered species. It is very closely related to the only other Amazonian species of section *Floribundae* Engler, *S. paraensis* Ducke, from which it is basically distinguished by the number and shape of leaflets, leaf indument, and flower and fruit size.

We describe here a new species of *Simaba* Aublet (Simaroubaceae), *S. docensis*. Its geographical distribution is apparently restricted to southeastern Minas Gerais, Brazil, in the semideciduous forest of the Rio Doce basin. The closest species to *S. docensis* is *S. paraensis* Ducke.

The South American genus *Simaba* has 25 species, divided into three sections: *Tenuiflorae*, *Floribundae*, and *Grandiflorae* (Engler, 1874; Cronquist, 1944). They are trees or shrubs with pinnately compound leaves. The main diagnostic characters used to distinguish the three sections of *Simaba* are listed in Table 1. Section *Tenuiflorae* is an Amazonian taxon, whereas the other two sections are mostly extra-Amazonian. *Simaba paraensis* is noteworthy because it is the only Amazonian species of section *Floribundae*. Furthermore, it can have small flowers, as found in section *Tenuiflorae*, and it has stamen appendages as occur in section *Grandiflorae*. However, *S. paraensis* has large paniculate inflorescences and other flower characters similar to those found in *Floribundae*, which places it in this section. The new species resembles *S. paraensis* in its general appearance and because it has androecium characteristics of the section *Grandiflorae*. However, *S. docensis* fits better the characteristics of section *Floribundae* than *S. paraensis* because of its larger flowers.

Couepia monteclarensis Prance, another endemic species of the Rio Doce basin, is also taxonomically very close to two Amazonian congeneric species: *C. sandwithii* Prance and *C. bernardii* Prance (Prance, 1989). Other field collectors (J. A. Lombardi & K. Yamamoto, pers. comm. 1999) have noticed the occurrence of Amazonian species affinities in the semideciduous forest of the Rio Doce basin. The conservation and detailed studies of this forest can help us to understand the evolution and history of the South American forests.

Simaba docensis Franceschinelli & K. Yamamoto, sp. nov. TYPE: Brazil. Minas Gerais: Marliéria, Parque Estadual do Rio Doce, on peninsula at Lake Helvécio, 24 Nov. 1975 (fl), *Heringer & Eiten 15182* (holotype, MO; isotype, US). Figure 1.

Ad sectionem *Floribundae* Engler referenda, *S. paraensis* Ducke androecio similis, sed foliis 7–10 jugatis, foliolis subtus puberulis vel pilosis, floribus majoribus 8–10 mm longis differt.

Tree 10–30 m tall. Branches glabrous with gray bark, strongly grooved and furrowed longitudinally, with prominent transversal scars due to leaf and bud abscissions. Leaves with 6–21 leaflets, usually 7–10 jugate, at apex of the branches; rachis 7.5–20 cm long, cylindric, puberulous. Leaflets sessile or subsessile, opposite or subopposite, interjuga 2–1.5 cm long. Leaflet 2.5–5 × 1.1–1.7 cm, blade oblong to obovate or elliptic, chartaceous, apex usually acute, sometimes obtuse to rounded, with gland at the tip, lateral leaflet base usually oblique and terminally cuneate, puberulent beneath with prominent central vein, glabrescent and slightly wrinkled above with prominent and puberulent central vein; lateral veins not visible. Inflorescence paniculate, 8–22 cm long, with ferrugineous tomentose axes, secondary axes 1.5–11 cm long, usually forming a right angle with the primary axis, subtended by bracts narrowly oblong to obovate with gland on the tip, 2.0–5.0 cm long, flowers at

Table 1. Main diagnostic characters used to distinguish the three sections of *Simaba*.

Characters	Sect. *Tenuiflorae*	Sect. *Floribundaae*	Sect. *Grandiflorae*
Inflorescence type	raceme or small paniculate	large paniculate	large few-branched paniculate or pseudoraceme
Flower length	3.5–7 mm	(5.5–)7–15 mm	15–35 mm
Calyx	united at the base to the middle length	united to the middle length, rarely at the base and cupuliform (*S. insignis*)	cupuliform
Stamen appendage in indument	glabrescent to hairy, free from each other or slightly united, but not in a stamen tube	hairy, free or united, but not in a stamen tube (except *S. paraensis* and *S. docensis*)	hairy on their edges, hairs intertwined forming a stamen tube
Stamen appendage length	from ⅓ to ½ of the filament length, covering the basal part of the ovary to the whole ovary	from ½ to ¾ of the filament length, covering the ovary and part of the style	almost the same length as the filament, covering the ovary and almost the whole style
Geographical distribution	Amazonian region	mostly extra-Amazonian	mostly extra-Amazonian

the apex of the axes. Flowers 8–10 mm long, subtended by 3 pilose, greenish bracteoles with gland near tip. Sepals light green, triangular, united only basally, apex acute, 2–3 × 1.2–1.7 mm. Petals light green or slightly ferrugineous externally, tomentose above and beneath, 8–10 × 2–3 mm, oblong with apex rounded to acute. Stamens 5.5–6 mm long, filaments 5–5.5 mm long; appendage 4.2–4.7 mm long, adaxially pilose, completely united to filament, with two apical teeth; anthers 0.5–0.8 × 0.2 mm, oblong, white. Gynophores 1.5–2 mm high, pilose; ovaries 5-carpellate, 1.5–1.7 mm high, pilose, orange; styles 3–3.3 mm long; stigmas minute, 4–5-lobed. Drupes 2–2.2 × 1.5–1.6 cm, ellipsoid, densely ferrugineous pilose-villous.

The specific epithet "docensis" refers to the collection site of the type specimen, the Parque Estadual do Rio Doce. The only two collections known for this species were made in this region. We have tried to re-collect this species, but we could only find one tree at the same locality where the type specimen was collected. This suggests that *S. docensis* may be a rare species restricted to the Rio Doce Basin forest. Its geographical distribution is the simplest character that separates *S. docensis* from *S. paraensis*. All characters used to distinguish *S. docensis* from *S. paraensis* are presented in Table 2. Besides geographical distribution, leaflet apex shape, and secondary vein visibility, sepal and gynophore size and fruit color and size are the most helpful characters that separate these two species.

Paratypes. BRAZIL. **Minas Gerais:** Município de

Table 2. Main diagnostic characters used to distinguish *Simaba docensis* from *S. paraensis*.

Characters	*S. docensis*	*S. paraensis*
Geographical distribution	Minas Gerais (Zona da Mata), Brazil	Amazonian Region of Brazil, Bolivia, and Venezuela
Leaflet number per leaf	6–21	6–13
Leaflet size	2.5–5.0 × 1.1–1.7 cm	3.5–9 × 1.3–3.3 cm
Leaflet indument	puberulent beneath, glabrescent above	glabrous on both sides, sometimes with puberulent veins
Leaflet apex shape	usually acute, obtuse to rounded	retuse or obtuse to emarginate
Leaflet vein evidence	secondary veins not visible	secondary veins visible
Sepal size	2.0–3.0 × 1.2–1.7 mm	0.8–1.5 × 1.0–1.5 mm
Petal size	8.0–10.0 × 2.0–3.0 mm	5.5–9.0 × 1.5–3.0 mm
Gynophore size	1.5–2.0 mm high	0.7–1.7 mm high
Drupe size	2.0–2.2 × 1.5–1.6 mm	1.5–1.8 × 1.1–1.3 cm
Drupe indument and color	densely ferrugineous, pilose-villous	puberulent and yellow

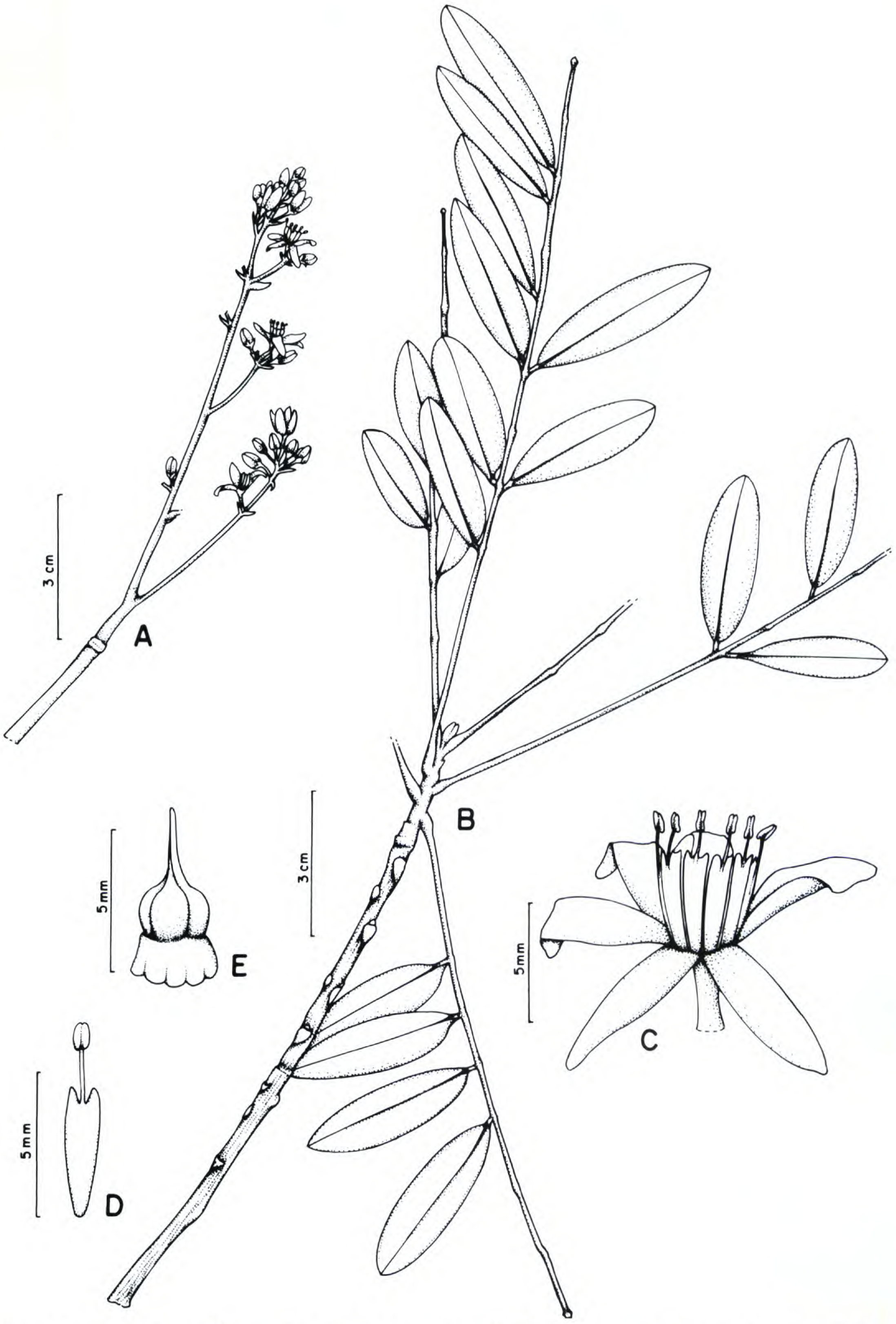

Figure 1. *Simaba docensis* Franceschinelli & K. Yamamoto. —A. Inflorescence. —B. Vegetative branch. —C. Flower. —D. Stamen. —E. Ovary and gynophore. A–E from *E. P. Heringer & Eiten 15182* (MO). Drawn by Edivani V. Franceschinelli.

Marliéria, Parque Estadual do Rio Doce, *Heringer & Eiten 15194* (NY, US).

Acknowledgments. We thank the curators of MO, NY, and US for making the materials of *Simaba* available to us for study. We are grateful to Tarciso S. Filgueiras for help with the Latin diagnosis and to Esmeralda Z. Borghi for help with the illustrations. This publication is part of a taxonomic study of the genera *Simaba*, *Simarouba*, and *Quassia*, carried out in the Depto. de Botânica, IB, UNICAMP, supported by a scholarship to E. V. Franceschinelli (Bolsa de Aperfeiçoamento da FAPESP, processo n° 83/2526-2).

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Two New Species of *Clusiella* (Clusiaceae) with a Synopsis of the Genus

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Abstract. Two new species of *Clusiella*, one from Costa Rica and Panama (*C. isthmensis*) and one from Brazil (*C. impressinervis*), are described, one old species from Colombia (*C. cordifolia* Cuatrecasas) is newly placed in synonymy, and all eight species in the genus are brought together in a key. A description of the genus and brief descriptions of the species are given, specimens are cited, and distributions are mapped for all species. In view of its stipuliform structures, contorted petals, psilate pollen exine, baccate fruits, exarillate seeds, and embryos with well-developed cotyledons, *Clusiella*'s presumed close relationship to *Clusia* is challenged.

Taxonomic History

When Planchon and Triana (1860) published *Clusiella* (based on *C. elegans*) the genus was considered monotypic and known only from pistillate flowers. It remained that way for nearly 100 years. However, Planchon and Triana appended to their treatment of *Clusiella* a full description of staminate material of a species now known as *C. axillaris* (Engler) Cuatrecasas. Planchon and Triana implied that the collections on which that description was based (*Spruce 2159* and *2854*) might belong to a second species of *Clusiella*, but they gave it no species name and presented the description under the heading "*Asthotheca*, Miers," with the prophetic injunction to see it "without prejudice as to placement among the other Clusioids" (Planchon & Triana, 1860, ser. 4, vol. 14: 254). Although all genera, except this one, are specifically designated as such in their large publication, Planchon and Triana did effectively publish the genus. The spelling "*Asthotheca*," however, must certainly have been a typographical error for *Astrotheca*; on page 240 of the same publication they referred to the "genre manuscrit *Astrotheca*, Miers." Bentham and Hooker (1862) repeated that error when they reduced "*Asthotheca*" to a section of the genus *Clusia*. Meanwhile, Engler (1888) published *Clusia axillaris* Engler based on the same two Spruce collections. Vesque (1892, 1893), using the correct spelling, and aware that "the discovery of its female flowers and of the male flowers of *Clusiella* might one day permit the combination of these two genera" (Vesque 1892: 16), assigned two species to *Astrotheca*, *A. cuspidata* Vesque and *A. sulphurea* (Poeppig) Vesque. The former was clearly a superfluous epithet because Vesque cited the earlier *Clusia axillaris* Engler and both Spruce collections. *Astrotheca sulfurea* is not a *Clusiella* (Cuatrecasas, 1950). Cuatrecasas (1949, 1950) finally brought *Astrotheca* (as to *A. cuspidata* Vesque) to rest in synonymy under *Clusiella* and described five new species.

Key and Descriptions

Clusiella Planchon & Triana, Ann. Sci. Nat. Bot. sér. 4. 14: 253. 1860. TYPE: *Clusiella elegans* Planchon & Triana.

Astrotheca Miers ex Planchon & Triana, Ann. Sci. Nat. Bot. sér. 4. 14: 254. 1860 (as "*Asthotheca*," a typographical error). No species indicated, but based on *Spruce 2159 & 2854*, from Brazil. LECTOTYPE, here designated: *Astrotheca cuspidata* Vesque (= *Clusiella axillaris* (Engler) Cuatrecasas).

Clusia subg. *Criuva* sect. *Astrotheca* (Miers ex Planchon & Triana) Bentham & Hooker, Gen. Pl. 1: 170. 1862 (as "*Asthotheca*").

Dioecious, epiphytic shrubs; resin (latex) clear; internodes lenticellate, bearing several pairs of caducous or rarely persistent bud scales usually clustered just above the node (one pair more distant). Minute, interpetiolar stipuliform structures present, these broadly triangular, scarious, drying dark, caducous. Petioles short, somewhat channeled by the narrowly decurrent leaf blade. Leaves opposite, the blades elliptic, sometimes cordate, ± coriaceous, occasionally glaucous in dried material; major lateral veins often very indistinct until dried, merging to a submarginal vein, the intersecondaries often almost as prominent as the secondaries; translucid (sometimes only with intense light) resin dots and dashes present, occasionally drying dark and superficially visible but then usually only on the lower surface, resin canals sometimes also visible on thin, new leaves. Inflorescences terminal or evicted by the growth of an axillary shoot and then appearing

axillary, at only one side of the node, short, 1–several-flowered, ± dichotomously branching cymes with numerous small, decussate bracts dispersed on the rachis. Flowers with 5 small imbricate sepals and 5 larger contorted petals, the petals white (maroon or wine-red), often with yellow or pink markings at the base within. Staminate flowers with the filaments connate for most of their length into a narrow column but free for a short distance apically and forming a ± globose capitulum, the column surrounded by a collar of clavate, resiniferous staminodia or resin globules; anthers ± globose and only slightly wider than the filaments (Figs. 1, 2); pollen spheroidal-oblate, tricolporate, psilate (Fig. 3). Pistillate flowers with the ovary surrounded by a resiniferous collar of staminodes that grade acropetally from resin glands to more clearly stamen-like structures; stigmas sessile, 5 to ca. 20, circular and distinct (when few) or packed into a disk and indistinctly triangular to rectangular (when many); ovules sometimes with a long funicle. Fruit a ± globose, many-seeded berry with about as many locules as stigmas; seeds elongate-ovoid, small (ca. 1 × 0.5 mm) with a clear, gelatinous outer integument attached only at the hilum, the exotegmen pitted (Figs. 4, 5), with sinuous anticlinal cell walls, lignified; endosperm white, embryo with cotyledons ca. ⅖ the length of the seed.

Distribution. *Clusiella* is restricted to the Neotropics, where species occur in Costa Rica, Panama, Colombia, Venezuela, Ecuador, northern Peru, and northern Brazil (Fig. 6).

KEY TO THE SPECIES OF *CLUSIELLA*

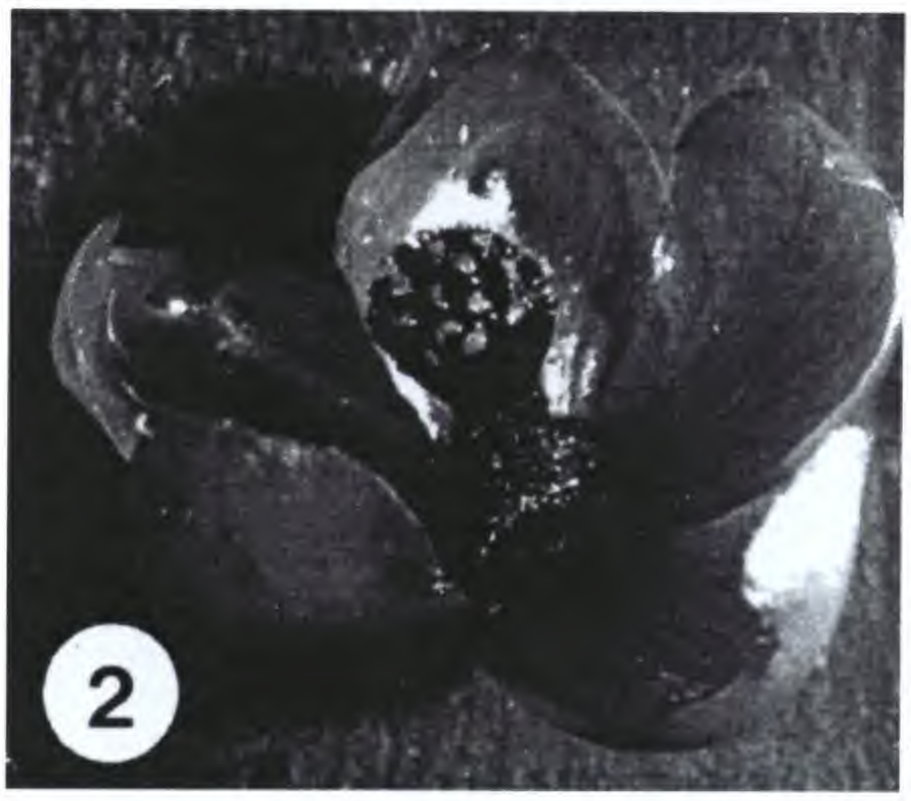
1a. Midrib impressed above; resin dots conspicuous (with hand lens) and prominent on both leaf surfaces . . . . . *C. impressinervis* sp. nov.
1b. Midrib prominent above; resin dots obscure and visible mostly only on lower leaf surface.
2a. Leaves amplexicaul; petioles 2 mm or shorter . . . . . *C. amplexicaulis*
2b. Leaves not amplexicaul; petioles 2 mm or longer.
3a. Petioles 8–10 mm; lateral veins mostly ca. 1 mm distant . . . . . *C. albiflora*
3b. Petioles mostly 5(–8) mm or less; lateral veins mostly ca. 2 mm or more distant.
4a. Fruits ± narrowly ovoid (ca. 5 mm diam. or less) with 5–7 distinct stigmas; leaves small, 4.5–5.5(–10) × 1–1.5(–4) cm . . . . . *C. elegans*
4b. Fruits globose, larger and with 10 or more connivent stigmas; leaves larger.
5a. Flowers wine-red [buds ca. 5 mm diam.; fruits ca. 1.5–2 cm diam.; twigs tan or white; leaf acumen ca. 2 cm; Valle del Cauca, Colombia, and Esmeraldas, Ecuador] . . . . . *C. pendula*
5b. Flowers white.
6a. Leaves drying dark brownish gray, never glaucous; twigs black; flower buds ca. 10–15 mm diam.; fruits, ca. 4 cm diam.; Amazonia (Brazil, Colombia, Peru, Venezuela) . . . . *C. axillaris*
6b. Leaves drying lighter, usually glaucous; twigs mostly brown to white; flower buds less than 10 mm diam.; fruits ca. 10 mm diam.
7a. Fruit wall thick (ca. 0.5–1 mm) and appearing woody in dried material; leaves strongly coriaceous, drying glaucous above and below, the apex usually abruptly acuminate, the petiole ca. 5 mm; Colombia . . . . . *C. macropetala*
7b. Fruit wall thin (ca. 0.2 mm), leathery; leaves membranaceous, rarely drying glaucous below, the apex gradually acuminate, the petiole 2–3 mm; Costa Rica and Panama . . . . . *C. isthmensis* sp. nov.

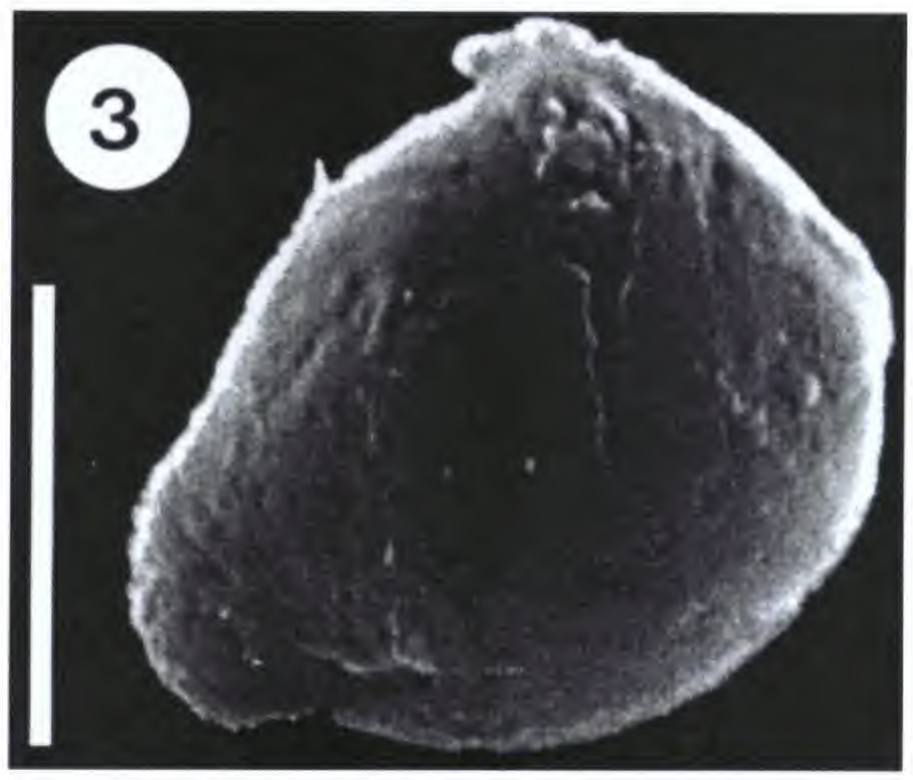
Clusiella albiflora Cuatrecasas, Anales Inst. Biol. Univ. Nac. México 20: 111. 1949. TYPE: Colombia. Valle del Cauca: Río Yurumanguí, Peña de Candelario, Costa Pacífica, 10 m, Feb. 1944 (stam. fl), *Cuatrecasas 16123* (holotype, F; isotype, US).

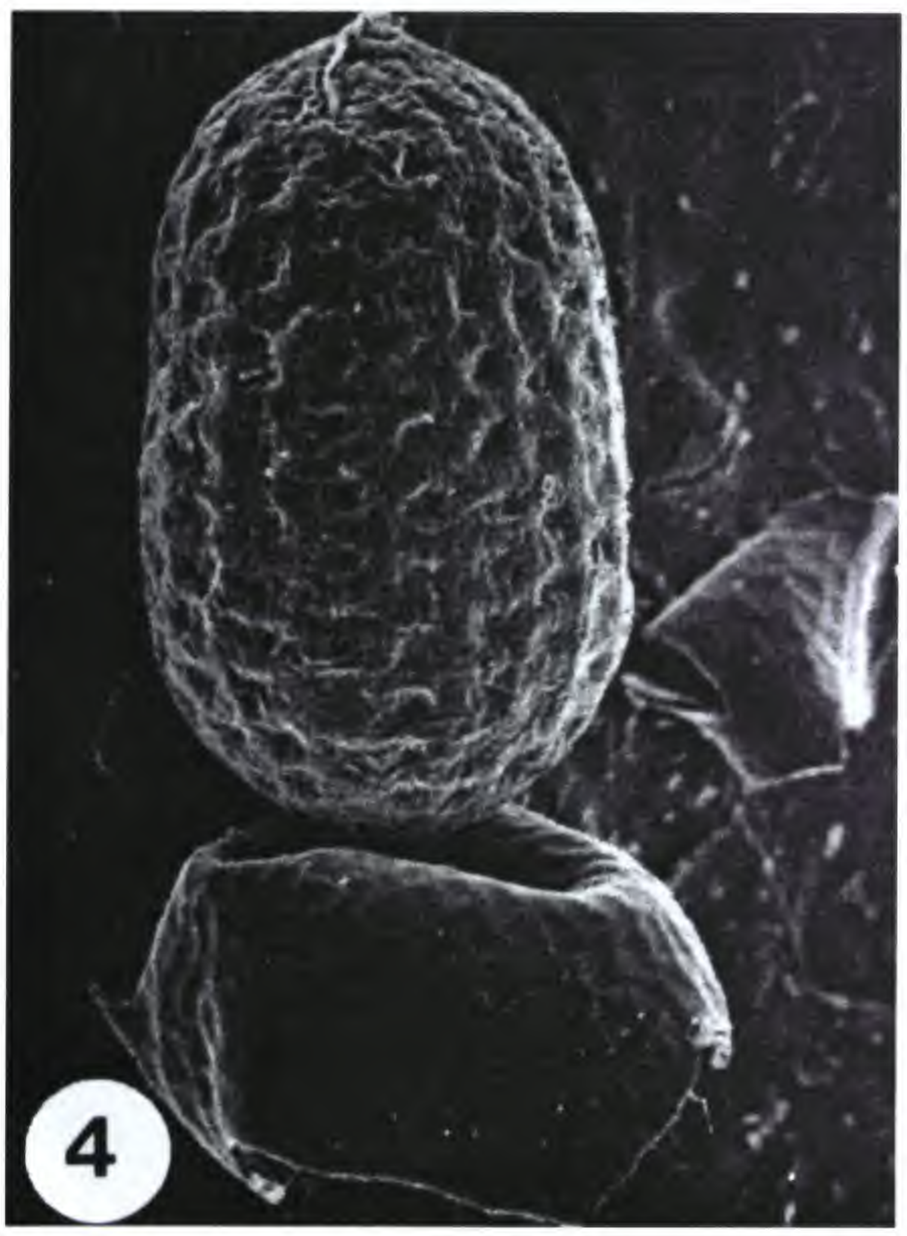
Bud scales sometimes persistent, to ca. 4 cm long, their scars up to 3.5 cm above the node. Petioles 8–10 mm; leaf blades elliptic, 8–12 × 4–6 cm, the base acute, the apex acuminate to a 1.5–2.5-cm acumen, drying glaucous above, dark tan above and below, lateral veins ca. 1–2(–4) mm apart, merging to a distinct submarginal vein ca. 1–1.5 mm from the margin, the intersecondaries prominent and easily confused with the secondaries. Inflorescences branched several times from above a peduncle ca. 5 mm long, 1–several-flowered; flower buds ca. 8 mm diam.; petals ca. 10 × 5 cm. Staminate flowers with the staminal column, including capitulum, very short, ca. 3 mm long. Fruits globose, ca. 10 mm diam., the stigmatic disk with ca. 6 closely packed, ± triangular stigmas, fruit wall rather thick, ca. 0.05 mm.

Distribution. Colombia, from near sea level.

This species is still known only from the type and one paratype. It has longer petioles and closer lateral veins than the other species, as well as a very long acuminate leaf tip and a very short staminal column. In leaf shape and color, though not in size, it appears most similar to *C. elegans.*







Figures 1–5. *Clusiella* (1–3, *C. elegans* Planchon & Triana; *Hammel & Kress 11287*; 4, 5, *C. isthmensis* Hammel, *Hammel & Trainer 12721*). —1. Staminate bud with petals removed, showing undehisced anthers and staminal column subtended by whorl of resinous staminodia. —2. Mature staminate flower. —3. Pollen grain. —4. Seed with integument laid back to show pitted exotegmen. —5. Seed with the clear integument partially removed. Scale bar: for Figs. 1, 4 & 5 = 3 mm; for Fig. 2 = 6 mm; for Fig. 3 = 10 μm.

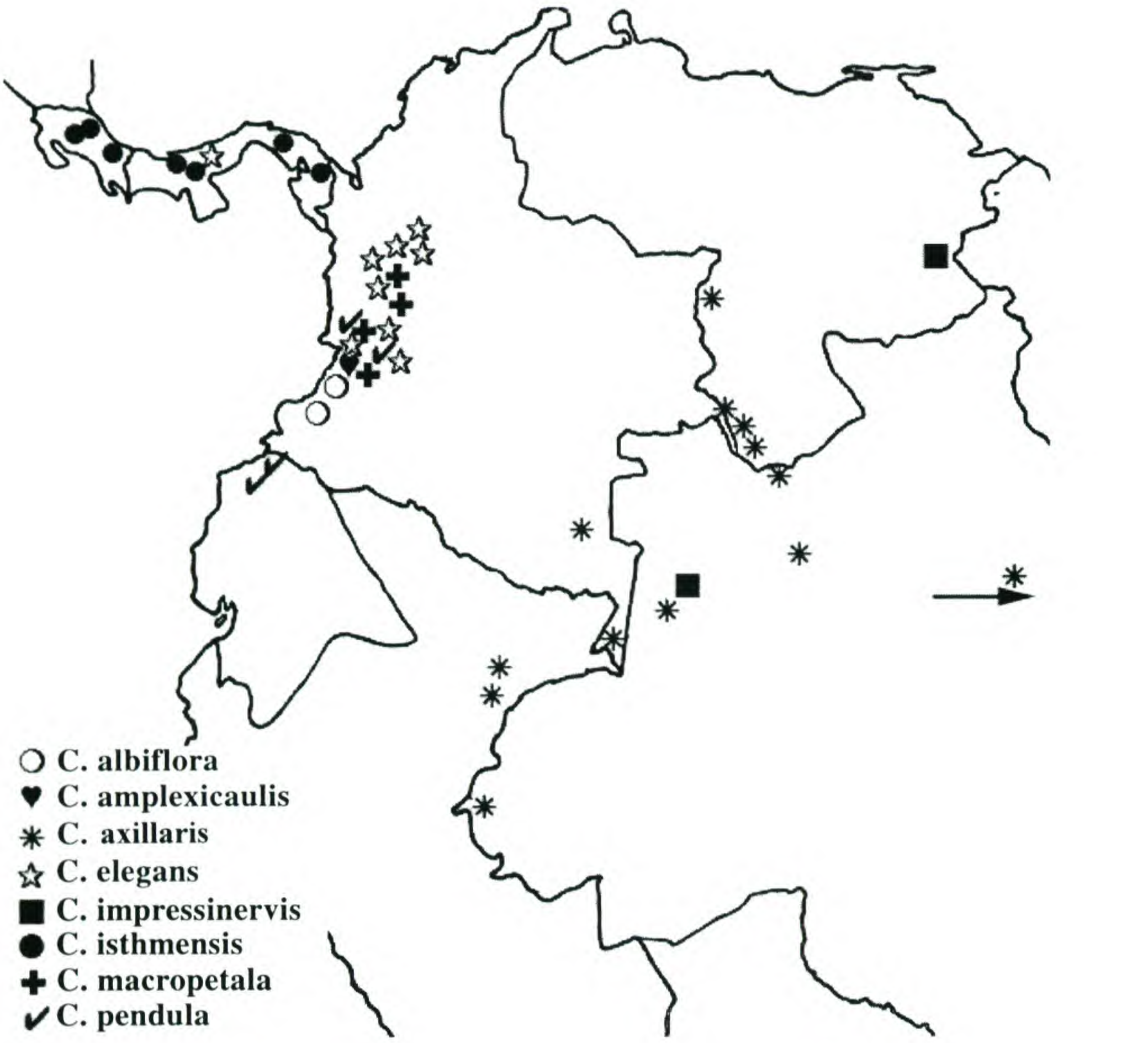


Figure 6. Distribution of *Clusiella*. (Occurrence of *C. axillaris* with an arrow pertains to off-map collection in Pará state of Brazil.)

Additional specimen examined. COLOMBIA. **Cauca:** Río Micay, Guayabal, Costa Pacífica, 5–20 m, Feb. 1943 (fr), *Cuatrecasas 14132* (F, US).

Clusiella amplexicaulis Cuatrecasas, Revista Acad. Colomb. Ci. Exact. 8: 61. 1950. TYPE: Colombia. Valle del Cauca: Río Cajambre, Barco, 5–80 m, Apr. 1944 (stam. fl), *Cuatrecasas 17188* (holotype, F).

Bud scales up to 7 mm above the node. Petioles indistinct, ca. 1–2 mm; leaf blades ovate, 13–15 × 7–9 cm, the base cordate and ± amplexicaul, the apex abruptly acuminate, drying slightly glaucous above, light tan on both surfaces; lateral veins (3–)5–10 mm apart, merging to a distinct submarginal vein ca. 2 mm from margin, the intersecondaries faint but occasionally reaching to the submarginal vein; translucid resin dashes faint. Inflorescence with ca. 1–3 flowers (in bud). Fruits unknown.

Distribution. Colombia, from near sea level.

This species is still known only from the type collection, material with immature staminate flowers only. The large, amplexicaul leaves with short petioles and distant primary lateral veins distinguish it from all other species. In leaf color and texture, *C. amplexicaulis* is similar to *C. elegans*.

Clusiella axillaris (Engler) Cuatrecasas, Revista Acad. Colomb. Ci. Exact. 8: 61. 1950. *Clusia axillaris* Engler, in Mart., Fl. Brasil. 12: 413. 1888. *Astrotheca cuspidata* Vesque, Epharm. Genitalia Foliaque Clusiearum et Moronobearum. 3: 16, tab. 80 & 81. 1892. TYPE: Brazil. Amazonas: São Gabriel de Cachoeira: Rio Negro, Jan.–Aug. 1852 (stam. fl), *Spruce 2159* (lectotype, here designated, GH; isolectotype, GOET; photo A, MO).

Bud scales sometimes persistent, 5–20 mm long, the scars up to 20 mm above the node. Petioles 4–9 mm, deeply channeled; leaf blades elliptic, 10–

13(–14) × 4–6(–7) cm, the base acute to rounded, the apex acute to acuminate to a 5–20-mm acumen, drying somewhat shiny, dark olive gray above, tan below, lateral veins 2.5–5 mm apart, merging to an indistinct submarginal vein 1 mm or less from the margin, intersecondaries ca. 1–2 mm apart; translucid resin dots visible only with intense light or on thin, new leaves. Inflorescence usually 1-flowered; flower buds to 1.5 cm diam.; petals to 2 × 1.3 cm. Staminate flowers with the staminal column, including capitulum, ca. 5–8 mm tall. Fruit to ca. 4 cm diam., the stigmatic disk with ca. 20 closely packed rectangular stigmas, fruit wall rather thick, ca. 0.5 mm.

Distribution. Amazonian Brazil, Colombia, and Venezuela, from ca. 100 to 750 m.

This species is easily recognized by virtue of its black twigs, dark-drying leaves, large flowers, and large fruits. It is distinctive also for its Amazonian distribution. It is probably related to *C. impressinervis* and *C. pendula.*

Additional specimens examined. BRAZIL. **Acre:** E slope of Serra da Moa, Apr. 1971 (stam. fl), *Prance et al. 12584* (MO); Rio Negro, Rio Cauaburí, 750 m, Nov. 1965 (stam. fl), *Maguire et al. 60422* (F, GH). **Amazonas:** Maraa, Rio Japurá, Dec. 1982 (pist. fl), *Plowman et al. 12252* (F); São Paulo de Olivença, Apr. 1944 (fl, fr), *Ducke 1626* (A, F, MO); basin of Rio Solimões, Dec. 1936 (stam. fl), *Krukoff 8626* (A, F, MO); basin of creek Belem, (stam. fl), *Krukoff 8933* (A, F, MO); Rio Solimões, Igarapé Jandiaruba, Jan. 1969 (fl), *Fróes 23906* (GH). **Pará:** Road BR 22, Camparema to Maranhão, km 66, vicinity of Piriroro, Nov. 1965 (pist. fl), *Prance & Pennington 1971* (GH). COLOMBIA. **Amazonas:** Leticia, Tarapacá, Parque Nacional Natural Amacayacu, 200 m, Nov. 1991, *Pipoly et al. 16055* (MO), 100 m, July 1992, *Rudas et al. 5471* (MO). **Guainía:** San Felipe Neri, on Río Negro, across from San Carlos de Río Negro, Venezuela, 120 m, May 1979 (stam. fl), *Clark & Clark 7161* (MO). **Vaupés:** Río Apaporis, Sorajama (above mouth of Río Kananarí) and vicinity, 275 m, (pist. fl), *Schultes & Cabrera 16089* (GH); Mitrú & vicinity, along Río Vaupes about 6 km below Mirú at Tukanaré, Aug. 1976 (fr), *Zarucchi et al. 1883* (GH). PERU. **Loreto:** Maynas, Mishana, Río Nanay between Iquitos and Santa María de Nanay, 150 m, Mar. 1979 (stam. fl), *Gentry & Aronson 25305* (F, MO), 130 m, Nov. 1978, *Diaz et al. 1984* (MO); Alipahuayo (Estación IIAP), Nov. 1984 (pist. fl), *Vásquez et al. 5887* (F, MO); Requena, Jenaro Herrera, Río Ucayali, May 1982 (fr), *Encarnación 26132* (MO); Sapuena, Jenaro Herrera, 170 m, Nov. 1987 (stam. fl), *Vásquez et al. 10051* (F, MO). VENEZUELA. **Territorio Federal Amazonas:** Dept. Atures, Río Autana, 90–110 m, Nov. 1984 (fr), *Guanchez 3249* (MO); Dept. Río Negro, middle part of Río Baría, 80 m, July 1984 (fr), *Davidse 27549* (MO); 3 km NE of San Carlos de Río Negro, 120 m, Apr. 1979 (stam. fl), *Liesner 6777* (MO); Ríos Pacimoni-Yasya, Casiquiare, 100–140 m, Jan. 1954 (stam. fl), *Maguire, Wurdack & Bunting 37439* (GH); Río Negro, Picora de Cocuí, Dec. 1947 (stam.? fl), *Schultes & López 9436* (GH).

Clusiella elegans Planchon & Triana, Ann. Sci. Nat. Bot. 13 (sér. 4): 254. 1860. TYPE: Colombia. Chocó: 2000 m, 1866 (fr), *Triana s.n.* (holotype, P; isotypes, F-fragment, G [photo F, MO], W [photo MO]).

Bud scales inconspicuous, their scars clustered at or just above the nodes. Petioles 1–2(–3) mm; leaf blades elliptic, 4–4.5(–10) × 1–1.5(–4.5) cm, the base acute (rarely rounded), the apex acuminate to a 1–1.5(–2)-cm acumen, drying glaucous and olive green above, shiny and tan below, lateral veins 2.5–5 mm apart, merging to an indistinct submarginal vein ca. 1 mm from the margin, intersecondaries faint, ca. 1–2 mm apart; resin dots and dashes translucid or sometimes dark. Inflorescences unbranched or often with up to 6 branches; flower buds 2–4(–6) mm diam.; petals ca. 4 × 3 mm. Staminate flowers poorly known, the staminal column, including capitulum, ca. 2(–6?) mm tall. Fruits ovoid, 4–8(–12) × 3–5(–10) mm, somewhat apiculate; stigmas 5–7, ± distinct, circular.

Distribution. Panama and Colombia from near sea level to 2000 m.

Originally described from pistillate material, this species is still known from very few staminate collections. Only three such collections are known: one from the disjunct population in Panama (*Hammel & Kress 11287*) and two from Colombia (*Garcia-Barriga 11130* and *Luteyn et al. 10682*). In general, the plants are much more delicate than the other species, but *C. elegans* is particularly distinguished by its small, ovoid fruits with 5–7, more or less distinct stigmas. As discussed below, the large-leaved forms of *C. elegans* look much like *C. isthmensis* and also like the small-leaved forms of *C. macropetala.* Indeed, the glaucous upper surface of the leaves, as well as their color and venation, suggests that the three species are closely related. *Betancur 802* (cited below) has leaves that are large for the species and somewhat glaucous below as in *C. macropetala.* The fruits of that collection are also large for the species, but in concordance with placement in *C. elegans* they have a thin and leathery, rather than thick and bony, fruit wall, and the stigmas are few and more or less distinct.

Additional specimens examined. PANAMA. **Coclé:** between Llano Grande and Coclecito, 600 m, July 1979 (fr), *Antonio 1396* (MO), Dec. 1979 (fr), *Antonio 3050* (MO), Mar. 1982 (stam. fl), *Hammel & Kress 11287* (DUKE). COLOMBIA. **Antioquia:** Amalfi a Rumazón, 1550 m, Sep. 1988 (fr), *Betancur et al. 802* (MO). **Chocó:** between La Oveja and Quibdó, Apr. 1931 (fr), *Archer 1753* (US); 15 km E of Quibdó, 75 m, Apr. 1931 (fr), *Archer 2214* (US); Quibdó, Carretera Yute–Lloró, 70 m, Sep. 1976 (fr), *Forero & Jaramillo 2721* (MO), 80 m, June

1983 (fr), *Forero et al. 9700* (MO), 100 m, Aug. 1976 (fr), *Gentry & Fallen 17817* (pro parte, mixed collection with *C. macropetala*, MO), Nov. 1988 (fr), *Ramirez 1* (MO); highway Bolivar–Quibdó, km 52–70, 500–600 m, July 1944 *Garcia-Barriga 11130* (US); km 175–176, 456 m, Mar. 1984 (fr), *Juncosa 2578* (MO); 37–40 km W of El Carmen, 671–1360 m, May 1984 (stam. fl), *Luteyn et al. 10682* (MO); road to Cabí SW of Tutuendo, 100 m, 19 Jan. 1979 (fr), *Gentry & Renteria 24450* (MO); Río Serrano, 4–6 km arriba de Guayabal, 50 m, Apr. 1975 (fr), *Forero et al. 1362* (MO). **Valle del Cauca:** Buenaventura, Bajo Calima, 50 m, July 1988 (fr), *Croat 69479, 69515* (MO), Dec. 1981 (fr), *Gentry 35589* (MO), ca. 100 m, July 1984 (fr), *Gentry & Monsalve 48413* (MO), Feb. 1989 (fl), *Gentry et al. 65553* (MO), June 1987 (fr), *Monsalve 1509* (MO), Oct. 1987 (fr), *Monsalve 1982* (MO), 50–100 m, Feb. 1984 (fr), *Juncosa 2125* (MO); Buenaventura to Cali, 100 m, June 1944 (fr), *Killip & Cuatrecasas 38926* (F, GH, US); Punta Arenas, Buenaventura Bay, near sea level, June 1944 (fr), *Killip & Cuatrecasas 38647* (US); Quebrada de Aguadulce, 0–10 m, Feb. 1946 (pist.? fl), *Cuatrecasas 19996* (F, US).

Clusiella impressinervis Hammel, sp. nov. TYPE: Brazil. Amazonas: Tonantins, Mar. 1944 (stam. fl), *Ducke 1625* (holotype, US; isotypes, A, F). Figure 7.

A speciebus aliis *Clusiellae* in costa supra impressa et punctis resiniferis utrinque foliorum manifestis, differt. *Clusiella axillaris* fortasse affinis, sed foliis et floribus minoribus.

Bud scales often persistent, several sets borne just above the node and one pair borne further above. Petioles 2–3 mm, deeply channeled; leaf blades elliptic to obovate, widest at or above the middle, (7–)8–9 × (2.5–)3–3.5 cm, the base acute, the apex abruptly acuminate to a 1.5-cm acumen, drying shiny, light green on both surfaces; lateral veins mostly 1.5(–3) mm apart, merging to a very indistinct submarginal vein mostly hidden along the recurved margin; resin dots very conspicuous on both surfaces. Inflorescences apparently 1-flowered; flower buds 7–8 mm diam.; petals ca. 10 mm long × 7 mm wide, white. Staminate flowers with the staminal column, including capitulum, ca. 4 mm tall, filaments ± free apically but congested. Pistillate flowers and fruits unknown.

Distribution. Brazil and Venezuela, from ca. 50 to 1220 m.

Since *Clusiella impressinervis* is so poorly known it is difficult to relate to the other species. However, by virtue of its non-glaucous leaves, its deeply channeled petioles, its persistent bud scales, and its Amazonian distribution, the species may be related to *C. axillaris*. Leaves of that species also occasionally have resin dots visible on the upper surface. The new species differs from *C. axillaris* by its smaller leaves and flowers and from all species not only by its impressed midrib but also because its leaves dry light green on both surfaces. More material, especially fruiting, is needed to clarify its relationships.

Paratypes. VENEZUELA. **Bolívar**: Cerro Venamo, 1220 m, Jan. 1964 (fl bud), *Steyermark et al. 92790* (F, US).

Steyermark et al. 92790 will key to *C. impressinervis* by virtue of its impressed midrib and resin dots on both leaf surfaces. It also has deeply grooved petioles and somewhat persistent bud scales. However, it differs from the type by its ovate leaves, ca. 6–7 × 3 cm, which are widest below the middle, have a rounded base, and dry dull on both surfaces, with upper surface olive gray and the lower reddish tan, and by its shorter petioles only ca. 1–2 mm long. It is also found at a much higher elevation and is the easternmost collection known of the genus. By virtue of sharing unusual vegetative characters with *C. impressinervis*, this specimen is tentatively included here. The description of the species is based on the type collection alone.

Clusiella isthmensis Hammel, sp. nov. TYPE: Costa Rica. Limón: Cerro Coronel, 5 m, Sep. 1986 (fl, fr), *Davidse & Herrera 31421* (holotype, CR; isotypes, F, MO) Figure 8.

Clusiella macropetala Cuatrecasas affinis sed in exocarpio coriaceo (non osseo) folia membranaciore, et petiolio breviore differt.

Bud scales mostly deciduous, their scars congested at or near the nodes, rarely persistent (*Kennedy et al. 2394*) with a pair up to 3.5 cm long appearing above the node. Petiole 2–3 mm, somewhat channeled; leaf blades elliptic-lanceolate, widest below the middle (6–)8–14 × (2–)3–4.5 cm, the base acute to rounded, the apex gradually acuminate to a 1–2-cm acumen, in dried material brown to glaucous and gray above, tan and sometimes glaucous below, lateral veins 2–3(–5) mm apart, merging to an indistinct submarginal vein mostly less than 1 mm from and hidden along the recurved margin; translucid resin dots and dashes sometimes also surficially visible on lower surface. Inflorescences mostly 1(–3)-flowered; petals ca. 10 × 6 mm, white. Staminate flowers with the staminal column, including capitulum, ca. 6 mm tall, the filaments free for a short distance apically. Pistillate flowers with apparently 10 stigmas, but these forming a disk and difficult to distinguish; ovary 10-celled. Fruits ca. 1 cm diam. at maturity, translucent white, soft.

Distribution. Costa Rica and Panama, from near sea level to 1500 m.

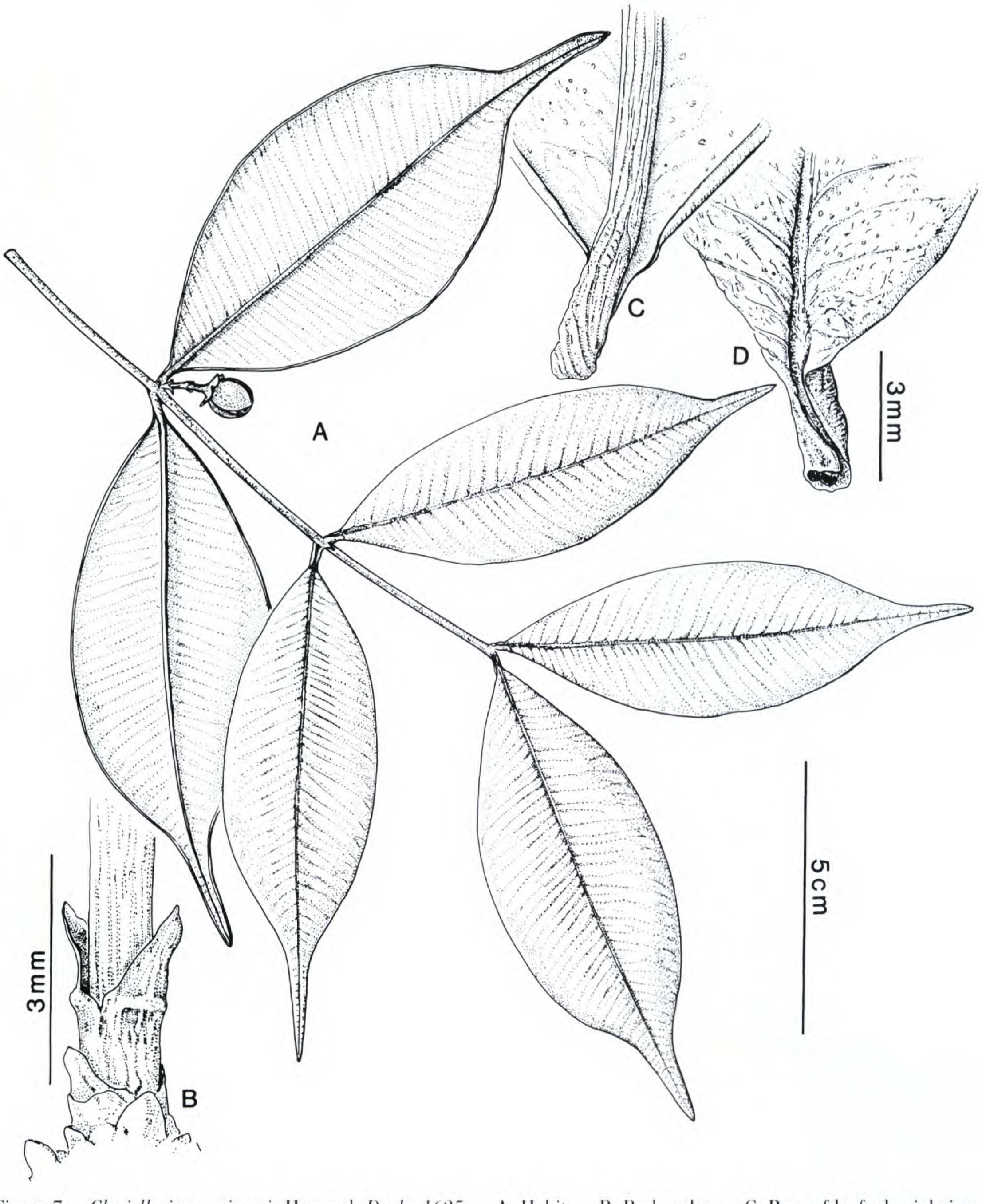


Figure 7. *Clusiella impressinervis* Hammel; *Ducke 1625.* —A. Habit. —B. Bud scales. —C. Base of leaf, abaxial view. —D. Base of leaf, adaxial view.

Although this species was previously identified as *Clusiella elegans* (D'Arcy, 1980; Hammel, 1986), it is more closely related to *C. macropetala.* As here understood, *C. elegans* is generally a much more delicate plant with smaller leaves, flowers, and fruits than both *C. isthmensis* and *C. macropetala.* Most importantly, the ca. 10 stigmas of the latter two species are more or less fused into a stigmatic cap, whereas those of *C. elegans* are fewer (ca. 5–7) and distinct. In addition to the characters mentioned in the diagnosis, *C. isthmensis* can be distinguished from *C. macropetala* by its generally smaller, more gradually acuminate leaf blades and by its shorter, thinner petioles. Nevertheless, in leaf size, shape, and color, both *C. macropetala* and *C. elegans* appear to overlap somewhat with *C. isth-*

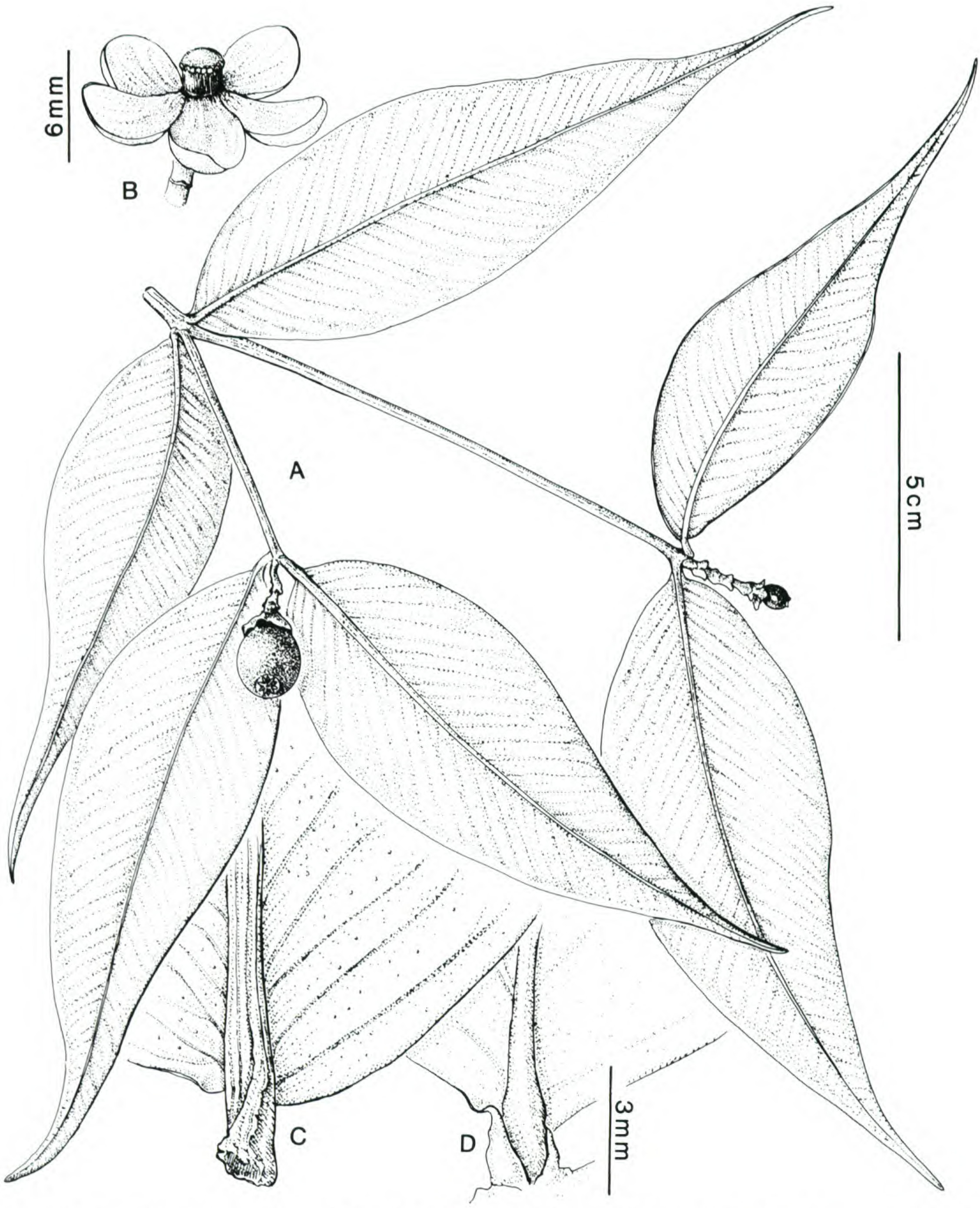


Figure 8. *Clusiella isthmensis* Hammel; *Davidse & Herrera 31421*. —A. Habit. —B. Pistillate flower. —C. Base of leaf, abaxial view. —D. Base of leaf, adaxial view.

mensis. The only other species that might be confused with *C. isthmensis* is *C. pendula* Cuatrecasas. However, the leaves of this species dry darker with more prominent lateral veins, are shiny rather than glaucous, and the flowers are red or maroon rather than white. One collection, *Foster et al. 14661*, from lowland Bocas del Toro province, Panama, is problematic. The leaf size, shape, and coloration, as well as flower color and fruit size, all correspond with *C. isthmensis*, but the fruits have fewer and nearly separate stigmas, more like those of *C. elegans*.

Original field notes for the type of this species indicate 11 duplicates. These were distributed as

C. elegans, and their whereabouts, except as indicated above, are uncertain.

Paratypes. COSTA RICA. **Heredia:** La Selva Biological Station just E of the juncture of the Sarapiquí and Puerto Viejo Rivers, ca. 100 m, (all collections from La Selva are pistillate), Apr. 1981, *Folsom 9673* (DUKE), Apr. 1981, *Folsom 9893* (DUKE, F, MO), Mar. 1980, *Hammel 8252* (DUKE, F, MO), May 1980, *Hammel 8625* (DUKE), June 1980, *Hammel 8934* (DUKE), July 1980, *Hammel 9286* (DUKE), June 1982, *Hammel & Trainer 12721* (DUKE), Aug. 1981, *Damon Smith 109* (DUKE, MO), Oct. 1981, *Damon Smith 457* (DUKE, F, MO); Parque Nac. Braulio Carrillo, between Río Peje and Río Sardinal, Atlantic slope of Volcán Barva, 1200–1400 m, Nov. 1985 (fr), *Grayum & Herrera 7867* (CR, MO); Estación el Ceibo, 520 m, Dec. 1992 (fr), *Boyle 1448* (CR); along W fork of Río Sardinal, Atlantic slope of Volcán Barva, 670 m, Dec. 1987 (fr), *Grayum 8501* (F, INB, MO). **Limón:** ca. 2 km S of Río Colorado along new road and ca. 1 km E, 5 m, Mar. 1987 (fl, fr), *Stevens et al. 25074* (MO); Cantón de Talamanca, entre Sukút y Amubri, 700–900 m, July 1989 (stam. fl), *Hammel et al. 17625* (CR); Alto Urén, 1190 m, July 1989 (stam. fl), *Herrera 3368* (INB, MO); Alto Lari, 1300 m, Mar. 1992 (stam. fl), *Herrera 5190* (INB, MO); 1500 m, Mar. 1992 (stam. fl), *Herrera 5422* (INB, MO). PANAMA. **Coclé:** Continental divide above El Copé, 750 m, Feb. 1982 (stam. fl), *Knapp & Dressler 3410* (MO). **Darién:** Río Tuquesa headwaters, ca. 2 km from continental divide, ca. 400 m, Aug. 1974 (fl, fr), *Croat 27213* (MO). **Panamá:** El Llano–Cartí road, ca. 350 m, Mar. 1973 (stam. fl), *Croat 22894* (MO), Feb. 1973, *Kennedy et al. 2394* (MO), Feb. 1973, *Kennedy et al. 2397A* (MO), Mar. 1973 (fl, fr), *Liesner 658* (MO), Mar. 1973 (stam. fl), *Liesner 1208* (MO), Nov. 1985 (fl), *McPherson 7585* (MO), Feb. 1975, *Mori et al. 4701* (MO), Feb. 1975 (fl, fr), *Mori et al. 4705* (MO). **San Blas Comarca:** El Llano–Cartí road, 13.8–15.8 km N of Interamerican Highway, 325 m, Aug. 1984 (stam. fl), *de Nevers et al. 3747* (MO); 19.1 km N of Interamerican Highway, 350 m, Nov. 1984 (fr), *de Nevers 4300* (MO). **Veraguas:** Atlantic slope NW of Santa Fe, 450–550 m, Dec. 1974 (stam. fl), *Mori et al. 3875* (MO).

Clusiella macropetala Cuatrecasas, Anales Inst. Biol. Univ. Nac. México: 110. 1949. TYPE: Colombia. Valle del Cauca: Río Cajambre, La Trojita, 5–50 m, 29 Feb. 1944 (stam. fl), *Cuatrecasas 16578* (holotype, F; isotype, US).

Bud scales deciduous, the scars clustered at or just above the nodes. Petioles 3–10 mm, shallowly channeled; leaf blades elliptic, (10–)13–19 × (4–)6–8 cm, the base acute to rounded, the apex acute to acuminate to a 5–15-mm acumen, in dried material glaucous on both surfaces, pale gray-green above, tan below, distinctly coriaceous; lateral veins 3–5(–7) mm apart, merging to a submarginal vein ca. 1 mm from margin, the intersecondaries often ± prominent; translucid resin dots and dashes visible only under intense light. Inflorescences unbranched or branched several times, with ca. 1–6 flowers; flower buds ca. 7–10 mm diam.; petals 10–17 × 6–10 mm. Staminate flowers with a staminal column, including capitulum, 5–10 mm tall. Fruits 8–12 mm diam., the stigmatic crest with ca. 10 closely packed stigmas, fruit wall rather thick, ca. 0.7 mm.

Distribution. Colombia, from near sea level to 700 m.

As noted above, the leaves of *C. macropetala* are glaucous on both surfaces and the fruits have a thick, several-layered fruit wall that is bony when dry. Smaller-leaved and smaller-flowered forms may otherwise be confused with *C. elegans* and *C. isthmensis* (q.v.), but *C. macropetala* is probably more closely related to the latter.

Additional specimens examined. COLOMBIA. **Antioquia:** Anorí, Valle de Anorí, entre Dos Bocas y Norí, 700 m, June 1971 (stam. fl), *Soejarto 2869* (F, MO, GH). **Chocó:** Quibdó–Istmina road to Lloró, ca. 100 m, June 1983 (fl, fr), *Forero et al. 9562* (MO), June 1983 (stam. fl), *Forero et al. 9591* (MO), June 1983 (fl, fr), *Forero et al. 9596* (MO), June 1982 (stam. fl), *Gentry & Brand 36855* (MO), June 1982 (fl, fr), *Gentry & Brand 36958* (MO), June 1982 (fl, fr), *Gentry & Brand 36963* (MO), Aug. 1976 (stam. fl), *Gentry & Fallen 17817* (pro parte, mixed collection with *C. elegans*, MO); San José del Palmar, hoya del Río San Juan, alrededores de Docordó, 0 m, Mar. 1979 (stam.? fl), *Forero et al. 4328A* (MO); Tutuendo–Quibdó road to Tubadó, 90 m, Jan. 1979 (fr), *Gentry & Renteria 24507* (MO). **Valle del Cauca:** Bajo Calima, Buenaventura, 100 m, Jan. 1988 (stam. fl), *Monsalve 2074* (MO); Río Cajambre, 5–80 m, May 1944 (stam. fl), *Cuatrecasas 17497* (F, US).

Clusiella pendula Cuatrecasas, Anales Inst. Biol. Univ. Nac. México 20: 109. 1949. TYPE: Colombia. Valle del Cauca: Bajo Calima, Buenaventura, Bahia de Buenaventura, 0–10 m, 20 Feb. 1946 (stam. fl), *Cuatrecasas 19877* (holotype, F; isotype, US).

Clusiella cordifolia Cuatrecasas, Revista Acad. Colomb. Ci. Exact. 8: 61. 1950. Syn. nov. TYPE: Colombia. Valle del Cauca: Bajo Calima, Buenaventura, coastal thickets, *Killip 11731* (holotype, US; isotype, GH).

Bud scales deciduous, the scars clustered at or just above the nodes. Petioles ca. 3–5 mm, shallowly channeled; leaf blades elliptic to cordate, (9.5–)11.5–16(–19) × (3.5–)4–6.5(–8) cm, the base acute or rounded to sometimes cordate, the tip acuminate to a ca. 2-cm acumen, in dried material often shiny (not glaucous) on both surfaces and dark olive above, dark brown below; lateral veins 2.5–4 mm apart, merging to a submarginal vein ca. 1 mm from margin, intersecondaries often also quite prominent; resin dots and dashes translucid. Inflorescence usually much-branched and with several flowers; flower buds ca. 5 mm diam.; petals ca. 10 × 5 mm, purplish brown (maroon) to red. Sta-

minate flowers with a staminal column, including capitulum ca. 3 mm tall. Fruits globose or slightly ovoid, ca. 15–20 × 10–15 mm, green(?) at maturity; stigmas ca. 8 or 9, closely packed and difficult to distinguish on fruits.

Distribution. Coastal Colombia and Ecuador from near sea level to ca. 800 m.

This species is easy to distinguish by virtue of its dark red instead of white or pinkish flowers and especially by its dark-drying, shiny leaves with prominent lateral veins. Based on the shape and color of its leaves, it is most similar to the Amazonian *C. axillaris.*

The many new collections from Colombia, Valle Dept., Buenaventura in Bajo Calima, near the type locality of both *C. pendula* and *C. cordifolia*, allow the conclusion that the latter should be considered a synonym of the former. The leaf color, texture, and venation of the type of *C. cordifolia* coincide with those of *C. pendula.* Although the type specimens differ in shape of the leaf base, it is now obvious that this can vary from acute to rounded to slightly cordate even on a single specimen.

A label or numbering mix-up may have occurred with the type specimen of *C. cordifolia.* As noted by Cuatrecasas in the original description of the species, the label reads "Tree, fruit blue." However, not only are trees and blue fruits otherwise unknown in the genus, the specimen is of a flowering staminate individual.

Additional specimens examined. COLOMBIA. **Valle del Cauca:** Bajo Calima, Buenaventura, Bahia de Buenaventura, Apr. 1939 (stam. fl), *Killip 34966* (F, US); coastal thickets, Oct. 1922 (stam. fl), *Killip 11731* (GH, US); el Forge, sea level, June 1944 (fl, fr), *Killip & Cuatrecasas 38962* (F, US); Carretera Hans, km 22, 50 m, Dec. 1987 (fl), *Gentry et al. 59554* (MO); Concesión Cartón de Colombia, 50–100 m, July 1987 (stam.? fl), *Faber-Langendoen & Renteria 1209* (MO), Dec. 1981 (sterile), *Gentry 35301* (MO), Feb. 1983 (stam. fl), *Gentry et al. 40394* (MO), Mar. 1986 (stam. fl), *Gentry et al. 53618* (MO), Apr. 1987 (stam. fl), *Gentry et al. 56701* (A, MO), Nov. 1986 (stam. fl), *Monsalve 1206* (MO), Dec. 1986 (stam. fl), *Monsalve 1405* (MO), Apr. 1987 (stam. fl), *Monsalve 1457* (MO), Sep. 1987 (fr), *Monsalve 1823* (MO), Oct. 1987 (stam. fl), *Monsalve 1892* (MO), Oct. 1987 (fr), *Monsalve 1933* (MO), Oct. 1987 (stam. fl), *Monsalve 1980* (MO), Jan. 1988 (stam. fl), *Monsalve 2083* (MO), June 1982 (stam. fl), *Murphy 558* (MO); Concesión Pulpapel, 100 m, Aug. 1984 (fr), *Monsalve 324* (GH); Quebrada Algeria, Bahia Malaga, 50 m, Dec. 1985 (pist. fl), *Gentry et al. 53334* (MO); Río Calima, La Esperanza, 5–10 m, Mar. 1944 (stam. fl), *Cuatrecasas 16761* (F, US); road to Juanchaco Palmeras, 100 m, July 1984 (pist. fl), *Gentry et al. 47819* (MO), July 1984 (fr), *Gentry et al. 48291* (MO). ECUADOR. **Esmeraldas:** San Lorenzo, 22 km from Lita on road to San Lorenzo, 800 m, May 1990 (fl), *Gentry et al. 69990* (MO); Alto Tambo, 15 km oeste de Lita, 400 m, Sep. 1990 (fr), *Rubio 618* (MO); Carretera Lita–Alto Tambo–La Punta, 400 m, Feb. 1991, *Gudiño & Moran 1263* (MO).

Relationships of the Genus

Discussing the placement of *Clusiella* within the family, Planchon and Triana (1860) pointed out that the contorted aestivaton of the petals was characteristic of the tribe Moronobeae (subfamily Moronoboideae of Engler, 1925). However, because of the sessile, largely cupuliform stigmas and non-ascendent ovules of *Clusiella*, they preferred to place it in their tribe Clusieae, although they were not certain of their disposition because of the lack of fruits and staminate flowers. Engler (1925) also felt that these incompletely known plants probably belonged next to *Clusia* in subfamily Clusioideae. Subsequent published accounts have made no explicit statements about possible relationships of *Clusiella*, although most imply a close relationship with *Clusia* (but see Hammel, 1984, unpublished thesis).

Numerous additional characters, including interpetiolar stipuliform structures, bud scales, resin gland-dots in the leaves, psilate pollen exine, baccate fruits, small fovelate seeds that lack an aril, and an embryo with unusually large cotyledons, are now known for *Clusiella* and make this genus very unusual, if not misplaced, among the clusioid genera. Stipuliform structures are uncommon in Clusiaceae, but ones similar to those found in *Clusiella* also occur in the Moronoboideae (e.g., *Moronobea, Symphonia*) and in *Garcinia* s.l. Bud scales also occur in *Moronobea* and *Symphonia* and in some related genera, while some species of *Garcinia* have one or two pairs of bud scales, and bud scales occur in some of the Calophylloideae. Contorted petal aestivation does not otherwise occur within the whole subfamily Clusioideae (Engler, 1925) but is most likely the primitive state for the family (P. Stevens, pers. comm. 1987). The psilate pollen exine of *Clusiella* also appears to be otherwise unknown within the family except for *Symphonia* and *Moronbea* (cf. Seetharam, 1983). It should be noted that Seetharam's study and light micrographs of "*Clusiella elegans Klug 1950,*" describing it as having "perreticulate" exine, pertain to a species of *Quapoya* (i.e., *Clusia*), not *Clusiella.* The small, foveolate seeds and embryo with well-developed cotyledons of *Clusiella* are most like those in the Hypericoideae and basal Calophylloideae, e.g., *Marila.* Were it not for its epiphytic habit, dioecy, and resiniferous androecium (all reminiscent of *Clusia*), but particularly because of its small foveolate seeds and embryo structure, *Clusiella* would seem to be closely related to *Symphonia.* More de-

tailed, comparative studies of pollen and the foliar resin system in particular are needed.

Characters such as those noted above in a sense pull *Clusiella* strongly outward and downward from *Clusia*. Work in progress toward an understanding of relationships among genera in the whole family in fact suggests that *Clusiella* may be sister to a large clade including both the Clusioideae and Moronoboideae (P. Stevens, pers. comm. 1987). The diminutive *Clusiella*, distinctively derived in many ways, and long masquerading as *Clusia*'s little cousin, seems to be an epiphytic refugium for a number of relatively primitive characters in the Clusioideae-Moronobiodeae, and could be called, more accurately, *Clusia*'s great aunt.

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Synopsis of *Chrysochlamys* (Clusiaceae: Clusioideae: Clusieae) in Mesoamerica

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ABSTRACT. Delimitation of genera in the *Tovomita* group of tribe Clusieae has fluctuated, in Central America, with almost every new floristic work. Nevertheless, with some aberrations, the theme of a unified *Chrysochlamys/Tovomitopsis* has persisted and is here supported by concurring with Bentham and Hooker's placement of *Tovomitopsis* in synonymy of *Chrysochlamys*. The strictly South American *Balboa* is also placed in synonymy of *Chrysochlamys*; this action necessitates a new name (here provided) for its only species. A key to the 13 species of *Chrysochlamys* recognized for Mexico and Central America is provided. An annotated list of all Mesoamerican *Chrysochlamys*, including brief descriptions, taxonomic and nomenclatural notes, five new combinations, and two new species, elucidates the generic concept and provides a rationalized nomenclature for use in numerous regional floras. *Tovomita croatii* Maguire, a somewhat problematic species, transferred to *Tovomitopsis* by D'Arcy, is included in the key to *Chrysochlamys* and fully discussed.

TAXONOMIC HISTORY

The *Tovomita* group of the tribe Clusieae (Clusiaceae, subfamily Clusioideae) comprises primarily arborescent, terrestrial genera with succulent-capsuled fruits and 1 (rarely 2) large arillate seed(s) per locule. Three genera therein, *Tovomita*, *Chrysochlamys*, and *Tovomitopsis*, have suffered a particularly tortuous taxonomic history. Planchon and Triana (1860) made the genus *Tovomitopis* to accommodate Sprengel's *Bertolonia*, a later homonym; *Bertolonia* Raddi (Melastomataceae) is now conserved over *Bertolonia* Spin (Myoporaceae) (Farr et al., 1979). Planchon and Triana distinguished *Tovomitopsis* from *Chrysochlamys*, claiming it had an arilloid (originating from the micropyle) rather than the true aril (originating from the funicule) they claimed for *Chrysochlamys*. According to them, the so-called aril of *Tovomita* is neither, but rather the outer integument of the seed. These differences were further supported by floral structure: *Tovomitopis*, calyx 4-merous; *Chrysochlamys*, calyx 5-merous; *Tovomita*, calyx 2- or 4-parted, the outer two sepals overtopping the bud. Planchon and Triana also described *Balboa* in the same publication with *Tovomitopsis*, but they placed it in their subtribe "Euclusiae" rather than Tovomiteae. Bentham and Hooker (1862: 167–176) recognized *Balboa*, *Chrysochlamys*, and *Tovomita* (as related) but treated *Tovomitopsis* as a synonym of *Chrysochlamys*. However, they transferred no species. Subsequently, *Balboa* was apparently forgotten in discussions relating to the *Tovomita* group. Hemsley (1879: 87) transferred all Central American species of *Tovomitopsis* to *Chrysochlamys*. Cuatrecasas (1950) also declared unjustified the separation between *Chrysochlamys* and *Tovomitopsis* and transferred two (South American) species to *Chrysochlamys*. Williams (1959) subsumed *Tovomitopsis* within *Tovomita*, but kept *Chrysochlamys* separate. Maguire (1977) tentatively recognized all three genera. D'Arcy (1980) expressed the same taxonomic opinion begun by Bentham and Hooker and put into practice by Hemsley and Cuatrecasas, i.e., a unified *Chrysochlamys/Tovomitopsis*, but used the later name, *Tovomitopsis*. D'Arcy also elevated Engler's section *Dystovomita* of *Tovomita* to the genus *Dystovomita*.

Most recently, an attempt has been made to circumscribe *Chrysochlamys* as comprising species with succulent petals, echinate pollen exine, and black seeds with white arils, rather than membranaceous petals, psilate-foveolate pollen, and green seeds with orange arils (cf. Hammel, 1984, 1986). Ignoring whether or not these characters support a monophyletic group or even if they coincide, typologically, with *Chrysochlamys*, neither such a separation, nor one based on the considerations of Planchon and Triana is practical. *Dystovomita*, with axillary inflorescences (i.e., mostly lateral and below the leaves), large, adaxial petiolar pits and relatively small seeds, is easily recognized and may even lie closer to *Clusia* (P. Stevens, in prep.). *Tovomita*, with terminal inflorescences, leaves clustered at the ends of side shoots, leaves sometimes with petiolar pits, outer two sepals fused in bud or at least overtopping the bud, styles often evident, fruits usually with the inner wall and placenta dark

reddish wine, can also be recognized, even with most herbarium material. The older name, *Chrysochlamys*, takes precedence over *Tovomitopsis* for the remaining species in the group, i.e., those with terminal inflorescences, leaves not clustered on side shoots, lacking adaxial petiolar pits, sepals (usually) not overtopping the bud, styles lacking, and the inner fruit wall and placenta mostly white or pink. *Balboa* is a synonym of *Chrysochlamys*.

The above paragraph can be summarized by the following key:

1a. Inflorescences apparently axillary; leaves with large, adaxial, margined petiolar pits; seeds ca. 6 mm . . . . . *Dystovomita*
1b. Inflorescences usually terminal; leaves mostly lacking petiolar pits; seeds ca. 1 cm or more.
  2a. Leaves clustered at the ends of side shoots; outer two sepals fused in bud or at least overtopping the bud; styles often evident; inner fruit wall and placenta usually dark reddish wine . . . . . *Tovomita*
  2b. Leaves ± evenly dispersed along the branches; outer two sepals never fused in bud, nor both overtopping the bud; inner fruit wall and placenta mostly white or pink . . . . . *Chrysochlamys*

Taxonomic Treatment

Chrysochlamys Poeppig, Nov. Gen. Sp. Pl. 3: 13, t. 211. 1842. TYPE: *Chrysochlamys multiflora* Poeppig.

Balboa Planchon & Triana, Ann. Sci. Nat. Bot., sér. 4, 13: 315, 14: 252. 1860. TYPE: *Balboa membranacea* Planchon & Triana.

Tovomitopsis Planchon & Triana, Ann. Sci. Nat. Bot., sér. 4, 14: 261. 1860. TYPE: *Tovomitopsis paniculata* (Sprengel) Planchon & Triana. Basionym: *Bertolonia paniculata* Sprengel.

Dioecious, terrestrial trees or shrubs, sometimes epipetric rheophytes, the branching decussate and the leaves dispersed ± evenly along the branches; resin mostly clear, occasionally white, rarely yellow; internodes mostly without bud-scale scars. Petiolar pits and interpetiolar stipuliform structures absent. Leaves opposite, the blades elliptic; major lateral veins mostly prominent, resin canals sometimes visible in dried material. Inflorescences terminal (rarely left pseudo-axillary by the dominant growth of an axillary, vegetative bud), many-flowered, panicles. Flowers 4- or 5-merous, corolla aestivation imbricate, petals thin, membranaceous, to thick and succulent, pink, or yellow to white. Staminate flowers with numerous (rarely few) ± separate stamens, or the filaments fused basally into a short column, or rarely with fertile stamens surrounding a central sterile capitulum, or very rarely the anthers all sessile on a resiniferous capitulum. Pistillate flowers with numerous separate staminodia, or staminodia mounted on a ring or rarely just a ring surrounding the ovary; ovary with mostly 4 or 5 stigmas, rarely 3. Fruits globose to ovoid, usually terete, rarely winged or star-shaped in cross section, succulent capsules mostly with 1 seed maturing per locule, sometimes only 1 seed per fruit; seeds green to nearly black with an orange or white aril.

Distribution and ecology. *Chrysochlamys* is known from Mexico to Bolivia and Brazil, where it occurs in wet to very wet primary forest from near sea level to at least 2300 m.

Chrysochlamys, in total, contains perhaps as many as 50 species, most of them South American, and is in much need of revision. At least two Central American species, *C. glauca* (Oersted, Planchon & Triana) Hemsley and *C. nicaraguensis* (Oersted, Planchon & Triana) Hemsley, have been erroneously reported from South America, and numerous South American names (e.g., *C. membranacea* Planchon & Triana, *C. micrantha* Engler, *C. myrcioides* Planchon & Triana) have been loosely (and erroneously) applied to Central American species, as well as within South America. The following key, distinguishing 13 species of *Chrysochlamys* for Mexico and Central America, and the subsequent annotated list, including citation of representative specimens and descriptions of two new species from Costa Rica and Panama, aim to clarify the species and names for the region. One or two possible new species, from among Panamanian material at hand, await resolution and are not included here.

Key to the Species of *Chrysochlamys* (and one *Tovomita*) in Mesoamerica

1a. Internodes with a pair of bud scales (or their scars), usually just above the subtending node; primary lateral veins close (ca. 3 mm apart), ± prominent but difficult to distinguish from the intersecondaries; inflorescences often appearing axillary; anthers sessile on a capitulum; stigmas 3; far eastern Panama to Ecuador . . . . . *C. tenuifolia*
1b. Internodes without bud-scales; primary lateral veins distant (usually 1 cm or more), these and the intersecondaries obscure or prominent; inflorescences unambiguously terminal; anthers with filaments; stigmas (4)5 or 6; Guatemala to northern South America.

2a. Leaves mostly < 2.5 cm wide, often drying tan; lateral veins very obscure in dry material.
3a. Flower buds 6–9 mm long; stamens 30–40; inflorescence and infructescence stout, fruits pyriform, but not rostrate, mostly 5-seeded; epipetric rheophytes . . . . . *C. angustifolia*
3b. Flower buds 3–4 mm long; stamens ca. 20; inflorescence and infructescence delicate, usually nodding or pendulous; fruits narrowly obovoid or pyriform and usually rostrate, mostly 1- or 2(3)-seeded; small shrubs in forest and sometimes along streams . . . . . *C. tenuis* sp. nov.
2b. Leaves mostly over 3 cm wide, drying green, gray-green, reddish tan, to tan; lateral veins easily seen in dry material.
4a. Leaf blades nearly sessile, 20–60 cm long; small shrubs < 2 m . . . . . *Tovomita croatii*
4b. Leaf blades distinctly petiolate, shorter; shrubs to trees, often over 3 m.
5a. Lateral leaf veins mostly < 9 pairs; calyx deciduous in fruit.
6a. Flower buds < 4 mm long; stamens ca. 20–30; inflorescence delicate, often pendulous; lateral leaf veins mostly ca. 1 cm apart; leaves usually dull, drying gray-green, often with obvious resin canals; Costa Rica and Panama . . . . . *C. glauca*
6b. Flower buds > 5 mm long; stamens 35 or more; inflorescence stout, erect; lateral leaf veins > 1 cm apart; leaves shiny.
7a. Leaves without obvious intersecondary veins or resin canals, the primary lateral veins usually 2–3 cm apart, the leaves drying gray-green; flower buds ca. 5–7 mm long; stamens 35–40; Nicaragua, Costa Rica, Panama . . . . . *C. nicaraguensis*
7b. Leaves with obvious intersecondary veins and often the resin canals also obvious, the primary lateral veins mostly 1–2 cm apart, the leaves drying reddish tan; flower buds ca. 5 mm long; stamens ca. 50; Mexico, Guatemala, Belize, Honduras . . . . . *C. guatemaltecana*
5b. Lateral leaf veins mostly > 10 pairs; calyx persistent or not.
8a. Submarginal leaf vein usually distinct, at least above mid-leaf; calyx persistent in fruit.
9a. Petals succulent; filaments fused basally, the free portion shorter than the fused portion; staminodia connate, forming a thin ring around the base of the ovary; fruits terete; central to eastern Panama . . . . . *C. eclipes*
9b. Petals membranaceous; filaments free to the base; staminodia distinct; Costa Rica to central Panama.
10a. Fruits star-shaped in cross section; anthers usually 2–3 times longer than wide; outer two sepals ± equal, shorter than the bud; flower buds ca. 7 mm long; inflorescence glabrous or pubescent . . . . . *C. grandifolia*
10b. Fruits terete; anthers about as wide as long; outer sepals very unequal, the larger ± equal to the bud; flower buds ca. 5 mm long; inflorescence glabrous . . . . . *C. skutchii* sp. nov.
8b. Submarginal leaf vein lacking or indistinct; calyx deciduous or persistent.
11a. Calyx deciduous in fruit; plants from the mountains (mostly > 1000 m) of Costa Rica and western Panama; lateral leaf veins 9–15 distinct pairs; leaves drying tan to pink or green.
12a. Fruits ± pyriform, ca. 2–2.5 cm long, often greenish yellow at maturity and the stigmas set to one side; stamens > 50; relatively large (ca. 15 m) trees with ± coriacious, tan- to pink-drying leaves; 700–2000 m . . *C. allenii*
12b. Fruits usually obovoid-mammillate, often 4 cm or more long, mostly red at maturity, the stigmas centered; stamens mostly ca. 15–20; shrubs or small trees (ca. 7 m or less) with membranaceous, mostly green-drying leaves; 800–1500 m . . . . . *C. psychotriifolia*
11b. Calyx persistent in fruit; plants from lowland Costa Rica (30–900 m) or from central and eastern Panama; lateral leaf veins 10–17 pairs, sometimes nearly indistinguishable from the intersecondaries; leaves usually dark, reddish brown to tan-drying.
13a. Fruits strongly alate; leaves narrowly elliptic, often falcate, ± coriaceous, the apex gradually acuminate, the resin canals very obvious on dry material; outer pair of sepals ± equal and nearly as long as the bud; resin canals of petals obvious; resin of stems white; lateral leaf veins 10–13; far eastern Panama . . . . . *C. membrillensis*
13b. Fruits not alate; leaves oblong to elliptic, not falcate, membranaceous, the apex abruptly acute to acuminate, the resin canals obscure; outer pair of sepals very unequal, the smaller much shorter than the bud; resin canals of petals obscure or lacking; resin of stem clear or white.
14a. Stamens ca. 50; leaves broadly elliptic, mostly 8–10 cm wide; lateral leaf veins mostly 11–17 distinct pairs; resin of stems clear; Costa Rica . . . . . *C. skutchii*
14b. Stamens 20–30; leaves elliptic to oblong, mostly 5–6(–9) cm wide; lateral leaf veins mostly 8–10 somewhat indistinct pairs, often difficult to distinguish from the intersecondaries; resin of stems white; Costa Rica and Panama . . . . . *C. silvicola*

Chrysochlamys allenii (Maguire) Hammel, comb. nov. Basionym: *Tovomitopsis allenii* Maguire, Phytologia 38: 214. 1978. TYPE: Panama. Bocas del Toro: Robalo Trail, northern slopes of Cerro Horqueta, 2000–2300 m, *Allen 5014* (holotype, NY; isotype, MO).

Tovomitopsis centistaminibus D'Arcy, Ann. Missouri Bot. Gard. 67: 1030. 1980. Syn. nov. TYPE: Panama. Chiriquí: 8 km N of Camp El Volcán, 2000 m, *Little 6070* (holotype, MO; isotype, US).

Trees 5–25 m, sometimes with stilt roots, occasionally reported as epiphytic; resin clear to creamy. Leaf blades elliptic to slightly obovate, widest just above the middle, 11–16 × 4–6 cm, the apex rounded to acuminate, the base acuminate, coriaceous; lateral veins ca. 0.8–1 cm apart, ca. 9–12 pairs, reaching to the margin; petiole 1–2 cm. Inflorescence 8–12 cm, erect, puberulent; flower buds ca. 5–7 mm; stamens 50 or more, anthers of both stamens and staminodia about as wide as long, < 1 mm, filaments free; stigmas large (ca. 2 mm), distinctly spreading. Fruits pyriform, 2–2.5 cm, yellow-green, the stigmas often mounted slightly to one side; calyx deciduous in fruit.

Distribution. Very wet cloud forest, (700–) 1450–2300 m; continuous from the Cordillera de Guanacaste in northwestern Costa Rica to Chiriquí province of western Panama and disjunct from Darién province in far eastern Panama.

A larger tree than any other *Chrysochlamys* in Central America and growing at higher elevations, *C. allenii* is further distinguished by its coriaceous leaves, numerous stamens (more than 50), often very large stigmas, and pyriform, often greenish yellow fruits.

Although D'Arcy (1980) compared *Tovomitopsis centistaminibus* with *T. psychotriifolia*, the type specimen's high-elevation habitat, large stature, coriaceous leaves, and numerous stamens conspire to alienate it from the latter species, and instead, to bring it into synonymy with *C. allenii*. This species, however, can at times be confused with *C. psychotriifolia*, which usually grows at somewhat lower elevations, has fewer (and often longer) stamens, and larger fruits. Material at hand, especially that from far eastern Panama, suggests that *C. allenii* may be closely related to, perhaps not distinct from, *C. colombiana* Cuatrecasas.

Representative specimens. COSTA RICA. **Guanacaste:** Volcán Cacao, 1100 m, Nov. 1990 (fr), *Espinoza 24* (INB). **Puntarenas:** Monteverde Reserve, 1500 m, June 1985 (fl, fr), *Hammel 13856* (MO); cloud forest above Wilson's finca S of San Vito de Java, 1600 m, Aug. 1967 (fr), *Raven 21845* (MO). **Heredia:** 12 km above San Rafael, 1800 m, July 1967 (fl), *Lent 1141* (MO). **San José:** La Palma, 1550 m, Aug. 1898 (fl), *Tondúz 7378* (MO). PANAMA. **Chiriquí:** 8 km N camp El Volcán, 2000 m, Mar. 1943 (fr), *Little 6068* (MO); about 2 km NE of Guadelupe, 2 km N of Cerro Punta, Dec. 1971 (fr), *Wilbur et al. 15331* (DUKE, MO); Bajo Mono–Robalo trail, 1600–2300 m, July 1947 (fl), *Allen 4839* (MO). **Bocas del Toro:** vicinity of Cerro Colorado, 1700 m, Apr. 1986 (fr), *McPherson 8925* (MO); vicinity of Fortuna Dam, 1200 m, Apr. 1986 (fl), *McPherson 9049* (MO). **Darién:** Cerro Sapo, 800–1000 m, Mar. 1986 (fl, fr), *Hammel et al. 14877* (MO).

Chrysochlamys angustifolia (Maguire) Hammel, comb. nov. Basionym: *Tovomitopsis angustifolia* Maguire, Phytologia 36: 399. 1977. TYPE: Panama. Veraguas: *Mori & Kallunki 5357* (holotype, MO; isotype, NY).

Small shrubs to 2 m, often on rocks along streams; resin milky. Leaf blades narrowly elliptic 7–13 × 1–2(–2.5) cm, the apex acute to acuminate, base acute, membranaceous, drying light gray-green or tannish green; lateral veins obscure, ca. 0.5–1 cm apart, ca. 5 or 6 pairs, reaching to the margin; petiole ca. 0.5–1 cm. Inflorescence ca. 6 cm, erect, glabrous; flower buds 6–9 mm; stamens 30–40, anthers of stamens and staminodia ± triangular, slightly longer than wide, ca. 1 mm, filaments free; stigmas spreading to often erect. Fruits pyriform, 1.5–2 cm, red or greenish red; calyx deciduous in fruit.

Distribution. Very wet, mostly lowland forest, usually along streams, 100–1000 m; Bocas del Toro to Veraguas and Coclé provinces of central Panama.

This distinctive, small, narrow-leaved, epipetric rheophyte with flower buds over 6 mm long is endemic to a few lowland or mid-elevation sites in west-central Panama. Its habitat, larger flowers, and stouter fruiting rachis easily distinguish it from the similarly narrow-leaved new species, *C. tenuis*, described below. Among Central American species, *C. angustifolia* is one of the few with copious milky resin rather than the more common clear to tardily creamy resin.

Representative specimens. PANAMA. **Bocas del Toro:** Upper Río San Pedro, 500 m, July 1979 (fr), *Gordon 59Da* (MO). **Veraguas:** vicinity of Santa Fe, dirt road past Escuela Alto de Piedra, 490 m, June 1987 (fl, fr), *Croat 66871* (MO). **Coclé:** along Río San Juan near fork with Río Tife, 400 m, June 1978 (fl, fr), *Hammel 3329* (MO).

Chrysochlamys eclipes L. O. Williams, Trop. Woods 111: 15. 1959. TYPE: Panama. Canal Zone: Barro Colorado Island, *Standley 31459* (holotype, US).

Shrubs or trees 2–10 m; resin clear. Leaf blades

elliptic to oblong, 12–26(–29) × 5–12 cm, the apex acute, base acute, membranaceous, drying dark reddish tan or rarely greenish tan; lateral veins obvious, 1–1.5 cm apart, 10–12 pairs, loop-connected to a submarginal vein ca. 1–3 mm from the margin; petiole ca. 1–3 cm. Inflorescence ca. 7–21 cm, erect or pendulous, minutely puberulous; flower buds ca. 4–5 mm; stamens ca. 25–30, anthers of stamens and staminodia wider than long, < 1 mm, filaments basally fused into a succulent torus, the free part of filaments < 1 mm, much shorter than the fused part; stigmas rounded, pressed against the ovary. Fruits mostly globose, 2–3 cm, green to greenish red or red; seeds black with a white aril; calyx persistent in fruit.

Distribution. Wet to very wet forest, from near sea level to 1600 m; central to eastern Panama.

A distinctive, usually dark-reddish-brown-drying, dull-leaved, Panamanian endemic (from the Canal to San Blas and Darién) with succulent and yellow rather than membranaceous white or pink petals, stamens with short, free filaments mounted on a succulent, fused basal portion, white rather than orange arils, and black rather than green seeds, not at all closely related to *C. nicaraguensis*, under which it was synonymized by D'Arcy (1980). This is the only species, described from the region, with succulent, rather than membranaceous, petals. Even in fruit it can be identified by the combination of large, dark-drying leaves and fused staminodia. The petals dry black or very dark burgundy.

Some of this material with particularly large inflorescences from far eastern Panama has been identified as *C. floribunda* Cuatrecasas and *C. weberbaueri* Engler. However, the abundant material at hand suggests that probably only one species is involved. Pending study of type material of the older, South American names, I here use *C. eclipes* for all Panamanian collections.

Representative specimens. PANAMA. **Colón:** end of Río Boquerón road, 500–650 m, Apr. 1978 (fr), *Hammel 2445* (MO); Río Guanche, Feb. 1974 (fl), *Foster 2780* (MO); Santa Rita Ridge Road, 450 m, Mar. 1975 (fr), *Mori & Kallunki 5049* (MO). **Canal Zone:** Barro Colorado Island, Mar. 1969 (fr), *Croat 8320* (MO); Pipeline Road, Sep. 1971, (fl), *Gentry 1946* (MO). **Panamá:** Cerro Jefe region, 750 m, Jan. 1986 (fr), *McPherson & Merello 8134* (MO); Gorgas Memorial Labs yellow fever research camp, 25 km NE of Cerro Azul on Río Piedras, 550 m, Nov. 1974 (fr), *Mori & Kallunki 3371* (MO); Llano–Carti road, 350 m, Aug. 1986 (fl), *McPherson 9962* (MO). **San Blas:** Cangandi, 30 m, Feb. 1986 (fr), *de Nevers & Herrera 7186* (MO). **Darién:** Cana–Cuasi trail, Chepijana, 1600 m, Mar. 1940 (fr), *Terry & Terry 1603* (MO); Parque Nacional del Darién, ridge between Río Topalisa and Río Pucuro, ca. 17 km E of Pucuro, 850 m, Oct. 1987 (fl), *de Nevers et al. 8380* (MO); slopes of Cerro Mali, 1300–1400 m, Oct. 1987 (fl & fr), *Cuadros et al. 3927* (MO); S of El Real on trail up Cerro Pirre, 550–1030 m, Mar. 1985 (fr), *McPherson 7045* (MO); trail to Cerro Pirre, 20–600 m, Aug. 1986 (fl), *J. F. McDonagh et al. 483* (MO).

Chrysochlamys glauca (Oersted, Planchon & Triana) Hemsley, Biol. Cent.-Amer., Bot. 1: 87. 1879. *Tovomitopsis glauca* Oersted, Planchon & Triana, in Planchon & Triana, Ann. Sci. Nat. Bot., sér. 4, 14: 264. 1860. *Tovomita glauca* (Oersted, Planchon & Triana) L. O. Williams, Fieldiana Bot. 29: 357. 1961. TYPE: Costa Rica. [San José]: sur le mont Jaris, [ca. 850 m], *Oersted 3* [*3589*] (holotype, C).

Tovomita gracilis L. O. Williams, Fieldiana Bot. 29: 357. 1961. TYPE: Costa Rica. Alajuela: San Pedro de San Ramón, 1050 m, *Brenes 4217* (lectotype, designated by Hammel (1986), F).

Tovomitopsis multiflora Standley, Field Mus. Nat. Hist. Bot. Ser. 4: 234. 1929. TYPE: Panama. Chiriquí: Progreso, *Cooper & Slater 171* (holotype, F–573,086; isotype, NY).

Shrubs or rarely trees 1–6(–14?) m; resin clear to slightly milky. Leaf blades elliptic, 7–20 × 2–7 cm, the apex and the base acute to acuminate, drying gray-green; lateral veins 0.5–1.5 cm apart, 6–10 pairs, fading toward the margin; petiole 1–2.5 cm. Inflorescence 2–12 cm, often pendulous, glabrous; flower buds ca. 3–4 mm, outer 2 sepals equal to markedly unequal, shorter than the inner ones; stamens 20–30, anthers of stamens and staminodia ovoid to ± globose, < 1 mm. Fruits pyriform to globose, 1–2 cm, greenish cream to nearly red, often two-toned; calyx deciduous in fruit.

Distribution. Wet to very wet forest, from near sea level to 1400 m; Costa Rica and Panama.

Even segregating the material described below as *Chrysochlamys tenuis*, *C. glauca* remains a rather variable species, characterized by its usually dull, few-veined leaves and small flower buds. Some of that variation may be worthy of taxonomic recognition. Many of the collections from the Osa peninsula in Costa Rica (cf. *Aguilar 431*, *Kernan 713*) have leaves with especially obvious and numerous latex canals and flower buds near the lower end of the size range for the species, giving such material an aspect predictive of its origin. Allen (1956: 345), in fact, distinguished two species from the Osa region within the *C. glauca* complex. For one (vouchered by *Skutch 5286*, F, not seen), he used the name *C. costaricana*, stating that it was "nearly identical" to *C. glauca*, "differing principally in the smaller flowers." Although *C. costaricana* (discussed below under *C. psychotriifolia*) is not its correct name, the species distinguished by

Allen may deserve recognition. Populations at the other end of Costa Rica, in the Cordillera de Guanacaste, have almost shiny leaves with relatively obscure lateral veins. The plants also appear to flower more on lateral shoots than material from elsewhere. The anthers are slightly longer and the stigmas are larger than those of *C. glauca* from elsewhere, usually at least ½ (vs. no more than ⅓–¼) the length of the ovary in newly opened flowers. Several collections from Panama, Panamá province and San Blas (*de Nevers 7223, Herrera et al. 1137, Herrera et al. 1145*), tentatively placed here, have unusually dense and much-branched resin lines and fruits with persistent sepals. These may represent a distinct species, but flowering material is needed.

Representative specimens. COSTA RICA. **Guanacaste:** Volcán Cacao, Rancho Harold, 700–1200 m, July 1986 (fr), *I. & A. Chacón 2154* (CR); Parque Nacional Guanacaste, Estación Cacao, 1100 m, Nov. 1990 (fr), *Chávez 368* (INB). **Alajuela:** Río Cataratas, San Ramón, 600 m, Jan. 1984 (fl), *Gómez-Laurito 9700* (CR). **Limón:** Cantón de Pococí, Barra del Colorado, 15–20 m, Jan. 1995 (fl), *Araya 713* (CR, INB, MO). **Puntarenas:** airport 4 mi. W of Rincón de Osa, 40 m, Aug. 1967 (fr), *Raven 21564* (CR); wooded slopes above Golfito, 0–80 m, Jan. 1967 (fl), *Burger & Mata 4775* (CR, F); Las Cruces, Jardín Botánico Wilson, 1100 m, Sep. 1993 (fr), *G. Vargas et al. 1369* (CR). PANAMA. **Bocas del Toro:** Río Teribe, alrededores de la estación Teribe II del IRHE, Oct. 1984, *Carrasquilla 2026* (MO). **Chiriquí:** E of Cañas Gordas near Costa Rican border on road to Volcán, 800–1200 m, Feb. 1973 (fl, fr), *Liesner 268* (MO); road from Nueva California to Río Serano, 1400 m, Apr. 1979 (fl), *D'Arcy et al. 13057* (MO). **Panamá:** Llano–Cartí road, 400 m, Jan. 1974 (fl), *Nee & Dressler 9371* (MO). **San Blas:** Cordillera de San Blas, cabecera del Río Piriati, 460–799 m, Feb. 1992 (fr), *Herrera et al. 1137* (MO).

Authorship of the four Central American *Tovomitopsis* names published in Planchon and Triana (1860) has been variously obfuscated in numerous publications, including my own. Oersted alone never published these names, as sometimes implied (cf. Williams, 1959), nor is there any basis for the even more common "Oersted ex Planchon & Triana" (cf. Standley, 1937; Croat, 1978; D'Arcy, 1980), let alone the terse permutation of the latter to just "Planchon & Triana" (e.g., Hammel, 1986). Since Anders Örsted (1812–1872) was professor of botany at the University of Copenhagen until 1862 (http://www.nathimus.ku.dk/bot/orsted.htm) during the time Planchon and Triana were working in Paris on their Guttiferae memoir, nothing suggests other than the three, "Oersted, Planchon & Triana," as co-authors, as originally indicated for all four species in Planchon and Triana (1860).

The citation of two collection (?) numbers for the types of these same four species results from examination of the actual specimens. The single-digit numbers are cited in the original publication (e.g., *Oersted 4*), and are also written on or in packets with the specimens. The four-digit numbers printed on the labels (e.g., Plantae Centroamericanae Oersted No. 3585) are not mentioned in the publication. Neither series appears to come from normal consecutive field-note numbers; earlier dates do not correspond, consistently, to lower numbers within the series.

Chrysochlamys grandifolia (L. O. Williams) Hammel, comb. nov. Basionym: *Tovomita grandifolia* L. O. Williams, Trop. Woods 112: 96. 1960, new name for *T. macrophylla* L. O. Williams, Trop. Woods 111: 16. 1959, non *T. macrophylla* (Poeppig) Walpers, 1842. TYPE: Costa Rica. Puntarenas: Esquinas forest, between Río Esquinas and Palmar Sur, 30 m, *Allen 5968* (holotype, US; isotypes, EAP, F).

Shrubs or trees 2–10 m; resin clear to yellowish. Leaf blades elliptic, 18–35 × 10–18 cm, the apex acute to rarely rounded, the base acute to acuminate, drying reddish; lateral veins 1–2 cm apart, 14–18 pairs, looping to form a ± distinct submarginal vein; petiole (2–)3–4 cm. Inflorescence ca. 6–10 cm, erect, glabrous; flower buds ca. 7 mm, outer 2 sepals ± equal to each other and shorter than the inner ones; stamens ca. 50, anthers of stamens and staminodia longer than wide, ca. 2 mm. Fruits ovoid, strongly 5- or 6-ribbed (star-shaped in cross section), greenish cream to nearly red, often two-colored; calyx persistent in fruit.

Distribution. Very wet forest, 10–600(–1300) m; Costa Rica to central Panama.

This distinctive Central American species, clearly delimited by its protologue, is characterized by strongly ribbed fruits and monomorphic stamens with anthers up to 2–3 times longer than wide. Costa Rican material from the Pacific slope has glabrous inflorescences and anthers nearly 2 mm long, whereas that of the Caribbean slope (also occurring at higher elevation than that of the Pacific) and the Panamanian collections have markedly puberulent inflorescences and smaller anthers.

This species was originally published as *Tovomita macrophylla* L. O. Williams, a homonym of the earlier *T. macrophylla* (Poeppig) Walpers; Williams, therefore, made a new name, *T. grandifolia*, for the same species. Coincidentally, an earlier *Chrysochlamys macrophylla* Pax would prevent the use of that combination for the present species, in any case. Nothing, however, prevents the use of the

combination *C. grandifolia* (L. O. Williams) Hammel.

Although D'Arcy (1980) created the combination *Tovomitopsis myrcioides* (Planchon & Triana) D'Arcy for this material (with *Tovomita grandifolia* as a synonym), the South American *C. myrcioides* Planchon & Triana is a quite different and poorly known species. It has very short petioles and the dimorphic stamens of section *Heterandra* "externa fertilia, libera, interna sterilia in corpus centrale concreta" (Planchon & Triana, 1860, vol. 14: 260) with nearly globose anthers. Furthermore, I know of no such rib-fruited *Chrysochlamys* species from South America. *Chrysochlamys membrillensis* (see below) of far eastern Panama also has somewhat ribbed fruits, but is otherwise quite different from the present species.

Representative specimens. COSTA RICA. **Cartago:** Turrialba, 2 km al oeste de Grano de Oro, 1200 m, July 1995 (fl), *Cascante 639* (CR). **Limón:** Cord. Talamanca, entre Cerro Chimú y Cerro Matama, 1200 m, Apr. 1985 (fl, fr), *Gómez & Herrera 23536* (CR); fila entre cuenca superior del Río Xichiari y cuenca superior del Río Boyei, 1300 m, Aug. 1995 (fl), *Herrera 8427* (CR). **San José:** ca. 20 km S of San Isidro de El General, El Pilar de Cajón, 620 m, Nov. 1988 (fr), *Zamora et al. 1521* (CR, MO). **Puntarenas:** Cantón de Osa, Fila al Oeste de Rancho Quemado, 300 m, Aug. 1991 (fr), *J. Marín 127* (CR, MO); Sierpe, cabeceras de Quebrada Guerra, 200 m, June 1990 (fl), *Herrera 4240* (CR, INB, MO); Corcovado National Park, trail from Los Chiles to base of hills, 20–400 m, July 1977 (fl), *Liesner 3175* (CR, MO); Los Planes (La Gloria), 100 m, Feb. 1991 (fr), *R. González 11* (CR, F, INB, MO); Cantón de Golfito, Refugio Nacional Golfito, S end of Fila Gamba, 160–200 m, Dec. 1988 (fr), *Grayum et al. 9180* (CR, MO). PANAMA. **Bocas del Toro:** road from Fortuna Dam to Chiriquí Grande, 400 m, Apr. 1986 (fl), *McPherson 9020* (MO). **Chiriquí:** Camino hacia la finca Landau, NE del campamento de Fortuna (Hornito), sitio de presa, 1100 m, Aug. 1976 (fr), *Correa et al. 2339* (MO). **Veraguas:** 5 mi. W of Santa Fe on road past Escuela Agrícola Alto Piedra, 800–1200 m, Mar. 1973 (fr), *Croat 23151* (MO). **Coclé:** El Copé, Atlantic slope E of sawmill, 900 m, Feb. 1979 (fr), *Hammel 6271* (MO). **Colón:** Santa Rita Ridge Road, 600 m, Feb. 1980 (fl), *Antonio 3756* (MO). **Panamá:** between peaks on Cerro Trinidad, May 1968 (fl), *Kirkbride & Duke 1647* (MO); Cerro Campana, near tower, Mar. 1977 (fr), *Folsom et al. 2311* (MO).

Chrysochlamys guatemaltecana Donnell-Smith, Bot. Gaz. 13: 26. 1888. *Tovomitopsis guatemaltecana* (Donnell-Smith) Standley & Steyermark, Publ. Field Mus. Nat. Hist., Bot. Ser. 23: 66. 1944. TYPE: Guatemala. Alta Verapaz: *von Tuerckheim 989* (holotype, US; isotype, NY).

Trees or shrubs 3.5–15 m; resin clear to pinkish. Leaf blades elliptic, 12–25 × 5–9(–10) cm, the apex acute, the base ± acuminate; drying tan to grayish tan and usually with rather obvious resin lines; lateral veins 1–2 cm apart, ca. 8–12 pairs, fading to the margin; petiole 1.5–2 cm. Inflorescence 7–15 cm, erect, glabrous; flower buds ca. 5 mm, the outer 2 sepals ± equal, < ½ the length of the bud; stamens ca. 50, anthers of stamens and staminodia about as long as wide, < 0.5 mm. Fruits pyriform, 2.5–4 cm, red tinged with green; calyx deciduous in fruit.

Distribution. Wet forest; 100–1450 m. Mexico to Belize.

This name has been considered a synonym of *Chrysochlamys nicaraguensis* (cf. Standley & Williams, 1961) and *C. psychotriifolia* (cf. Hammel, 1984). However, a clearer picture of variation within the genus throughout the region now supports its reinstatement. The species is characterized by more or less shiny, usually reddish-brown-drying leaves with rather few (6–9) and distant (1–2 cm) major lateral veins and usually quite prominent intersecondaries and obvious resin lines. The rather large flower buds (5–7 mm) have visible resin lines. It has more stamens (ca. 50) than either *C. nicaraguensis* (35–40) or *C. psychotriifolia* (ca. 20). The fruits are often quite elongate, up to 4 cm, as in *C. psychotriifolia*, and the sepals are early deciduous.

Representative specimens. MEXICO. **Oaxaca:** 18 km al este de Cuahutemoc, por la carretera Cuahtemoc–Sarabia, Dec. 1974 (fr), *Vazquez et al. 1482* (MO); Mpio. Matías Romero, 8.3 km al S de Esmeralda, luego 2.3 km al E, 110 m, May 1981 (fl, fr), *Wendt et al. 3267* (MO); Mpio. Sta. María Chimalpa, Río Verde, 360–430 m, July 1986 (fl), *Caletti et al. 210* (MO); Mpio. Minatitlán, lomas al S del Poblado 11, ca. 30 km al E del Campamento La Laguna, 180 m, July 1980 (fl, fr), *Wendt et al. 2642* (MO). GUATEMALA. **Alta Verapaz:** 7 mi. up road to Oxec, 700 m, July 1977 (fl), *Croat 41631* (MO). **Izabal:** Puerto Mendez, km 7, Sep. 1970 (fl), *Contreras 10237* (MO). BELIZE. **Toledo:** Central camp, Edwards Road beyond Columbia, June 1951 (fl), *Gentle 7354* (MO); SW Maya Mountains, Columbia River Forest Reserve, 750 m, Apr. 1992 (fl), *Holst 4407* (MO); vicinity of San José Mayan Indian village, June 1973 (fl, fr), *Croat 24450* (MO). HONDURAS. **Copán:** Parque Nacional Cerro Azul, 1440 m, Feb. 1992 (fr), *Hawkins & Mejía 184* (MO). **Olancho:** Refugio de Vida Silvestre La Muralla, 1400 m, June 1992 (fl), *Mejía 164* (MO).

Chrysochlamys membrillensis (D'Arcy) Hammel, comb. nov. Basionym: *Tovomitopsis membrillensis* D'Arcy, Ann. Missouri Bot. Gard. 67: 1036. 1980. TYPE: Panama. Darién: Upper Río Membrillo, 100–800 m, *Duke 10872* (holotype, MO).

Shrubs or trees to ca. 8 m; resin clear. Leaf blades narrowly elliptic, 16–25 × 4–6 cm, the apex

acuminate, the base acute and slightly decurrent, drying reddish to grayish tan and with numerous, closely spaced, often-branched, resin lines; lateral veins 1–2.5 cm apart, ca. 10 pairs, fading toward the margin and very indistinctly loop-connected; petiole 1–3.5 cm. Inflorescence ca. 10 cm, erect, glabrous; flower buds ca. 5–6 mm, the outer 2 sepals ± equal and as long as or shorter than the others; stamens ca. 40, anthers of stamens and staminodia slightly longer than wide, ca. 1 mm. Fruits ovoid-pyriform, ca. 3 cm, strongly alate but the wings thin, pink; calyx ± persistent in fruit.

Distribution. Very wet primary forest, 100–850 m. Known for sure from just five collections, only from Panama, low to middle elevations of Colón province and extreme eastern Darién province. This species must certainly also occur in nearby Colombia, but no such specimens have been seen.

This Panamanian endemic has narrowly elliptic and often falcate, coriaceous leaves, with very visible resin canals. The lateral leaf veins are without prominent intersecondaries, and the fruits are basically pyriform and winged. Although the winged fruits are very characteristic of this species, they are not obvious in young pistillate material or even more mature, dried material.

Specimens examined. PANAMA. **Colón:** Santa Rita Ridge Road, 600–700 m, Apr. 1981 (fl), *Sytsma et al. 4176* (MO); 250–400 m, May 1982 (fl), *Knapp & Schmalzel 5264* (MO). **Darién:** Parque Nacional del Darién, between Río Topalisa y Río Pucuro, 750–850 m, Oct. 1987 (fl, fr), *Hammel et al. 16282* (MO); Upper Río Membrillo, 100–800 m, Apr. 1967 (fr), *Duke 10863* (MO), Apr. 1967 (fr), *Duke 10901* (MO).

Chrysochlamys nicaraguensis (Oersted, Planchon & Triana) Hemsley, Biol. Cent.-Amer., Bot. 1: 87. 1879. *Tovomitopsis nicaraguensis* Oersted, Planchon & Triana, in Planchon & Triana, Ann. Sci. Nat. Bot., sér. 4. 14: 266. 1860. *Tovomita nicaraguensis* (Oersted, Planchon & Triana) L. O. Williams, Trop. Woods 111: 18. 1959. TYPE: Nicaragua. [Río San Juan]: along the Río San Juan, [ca. 10–50 m], *Oersted 2* [*3587*] (holotype, C).

Chrysochlamys standleyana L. O. Williams, Trop. Woods 111: 16. 1959, new name for *C. pauciflora* Standley, Ceiba 3: 214. 1953, non *C. pauciflora* Steyermark, 1952. *Tovomitopsis standleyana* (L. O. Williams) D'Arcy, Ann. Missouri Bot. Gard. 67: 1040. 1980. TYPE: Panama. Bocas del Toro: Chiriquí Lagoon, *von Wedel 1019* (holotype, F; isotype, MO).

Shrubs or trees, 3–8 m; resin clear. Leaf blades elliptic to obovate-oblong, 14–25(–27) × 6–10(–12.5) cm, the apex acute to rounded and apiculate, the base acute to acuminate, drying gray or tannish green, ± glossy; lateral veins 1.5–3 cm apart, (5–)6–8(–10) pairs, fading to the margin; petiole 1.5–4 cm. Inflorescence 3–19 cm, usually erect; flower buds 5–7 mm, outer pair of sepals ± equal to each other and shorter than the inner; stamens 35–40, anthers of stamens and staminodia about as wide as long, < 1 mm. Fruits obovoid to globose, 1.5–3 cm, greenish pink to red; calyx deciduous in fruit.

Distribution. Very wet forest of the Caribbean lowlands, from near sea level to 600(–1200) m; Nicaragua, Costa Rica, Panama.

Chrysochlamys nicaraguensis, often erroneously interpreted as a wide-ranging species (cf. discussion under *C. eclipes*), is still only known for certain from the very wet Caribbean lowlands of Nicaragua, Costa Rica, and adjacent Panama. It is distinctive for its very glossy and distantly veined (2–3 cm) leaves almost totally lacking visible intersecondaries and resin canals. For discussion of authorship and type specimen citation of this species, see under *C. glauca.*

Representative specimens. NICARAGUA. **Río San Juan:** Campamento La Lupe, ca. 15.5 km al Noreste del poblado El Castillo, 100 m, Dec. 1991 (fr), *Grijalva 5633* (CR). COSTA RICA. **Alajuela:** Cantón de San Ramón, camino al Volcán Muerto, 1100–1200 m, May 1993 (fl), *F. Araya et al. 294* (CR, INB, MO). **Heredia:** Cantón de Sarapiquí, La Selva Research Station, 100 m, Feb. 1981 (fr), *Folsom 8775* (CR, DUKE). **Limón:** Cerro Coronel, 60–100 m, Mar. 1987 (fl), *Stevens et al. 24851* (CR, MO); Parque Nacional Tortuguero, ca. 3 km al Sur del pueblo, 3 m, Nov. 1988 (fr), *Robles 2175* (CR, MO); Cantón de Talamanca, Aguas arriba de Río Banano, Fila Asunción, 400 m, Feb. 1995 (fr), *Rodríguez 580* (CR, INB, MO); hills between headwaters of Quebrada Mata de Limón and upper branches of Quebrada Tigre (Sixaola region), 25–30 m, Nov. 1984 (fr), *Grayum et al. 4468* (CR, MO). PANAMA. **Bocas del Toro:** Fish Creek Mts., vicinity of Chiriquí Lagoon, Apr. 1941 (fl), *von Wedel 2300* (MO); Peninsula Valiente, on E side of Lagoon of Chiriquí, 25 m, Aug. 1987 (fl), *McPherson 11453* (MO). **Veraguas:** valley of Río Dos Bocas along road between Escuela Agrícola Alto Piedra and Calovebora, 450–550 m, 31 Aug. (fl), *Croat 27581* (MO). **Coclé:** Alto Calvario, N of El Copé, 700–900 m, May 1977 (fr), *Folsom 3274* (MO); region N of El Valle, 1000 m, Sep. 1946 (fl), *Allen 3683* (MO). **Panamá:** Cerro Campana, 800 m, Aug. 1982 (fl), *Hamilton & D'Arcy 662* (MO); Finca El Indio at headwaters of Río Indio, slopes of Cerro Jefe, 750 m, Nov. 1979 (fl), *Antonio 2425* (MO). **Colón:** ca. 2–3 m up Río Guanche, 10–20 m, Jan. 1973 (fr), *Kennedy & Foster 2193* (MO). **San Blas:** Cerro Habú, 500–850 m, Dec. 1980 (fr), *Sytsma et al. 2676* (MO).

Chrysochlamys psychotriifolia (Oersted, Planchon & Triana) Hemsley, Biol. Cent.-Amer., Bot. 1: 87. 1879. *Tovomitopsis psychotriifolia* Oersted, Planchon & Triana, in Planchon &

Triana, Ann. Sci. Nat. Bot., sér. 4. 14: 263. 1860. TYPE: Costa Rica. [Cartago]: Turrialba, [ca. 650 m], *Oersted 4* [*3585*] (holotype, C).

Tovomitopsis costaricana Oersted, Planchon & Triana, in Planchon & Triana, Ann. Sci. Nat. Bot., sér. 4. 14: 265. 1860. *Chrysochlamys costaricana* (Oersted, Planchon & Triana) Hemsley, Biol. Cent.-Amer., Bot. 1: 87. 1879. TYPE: Costa Rica. [Cartago]: Turrialba [ca. 650 m], *Oersted 1* [*3588*] (holotype, C).

Tovomitopsis faucis D'Arcy, Ann. Missouri Bot. Gard. 67: 1031. 1980. Syn. nov. TYPE: Panama. Chiriquí: forests around El Boquete, 1000–1300 m, *Pittier 3039* (holotype, US).

Shrubs or trees, 3–10 m; resin clear or slightly creamy. Leaf blades oblong-elliptic, 12–21 × 3–8(–9) cm, the apex acute, the base acute to acuminate, dull, drying gray-green; lateral veins mostly 1(–1.5) cm apart, 10–15 distinct pairs, fading to the margin or somewhat loop-connected toward the leaf apex; petiole 1–2 cm. Inflorescence 6–16 cm, erect, minutely pubescent or glabrous; flower buds ca. 5–7 mm, outer 2 sepals ± equal to each other and shorter than the inner; stamens 15–20, anthers of stamens and staminodia about as long as wide, < 1 mm; stigmas ± reflexed. Fruits oblong and often apiculate, 3–5.5 cm, greenish yellow-pink to red; calyx deciduous in fruit.

Distribution. Very wet montane forest, 600–1500 m; Costa Rica and Panama.

Chrysochlamys psychotriifolia, well known in Costa Rica, is a species with numerous, rather close, lateral veins, few (ca. 20) monomorphic stamens, and usually large (3–5 cm), obovate-mammillate fruits. *Tovomitopsis costaricana*, *T. faucis*, and what D'Arcy (1980) called *T. membranacea* (Planchon & Triana) D'Arcy were based on very scant material that is, nevertheless, now seen to fall easily within the variation of *C. psychotriifolia*. For discussion of authorship and type specimen citation of this species, see under *C. glauca*. The South American *Chrysochlamys membranacea* Planchon & Triana, by its type and numerous more recent collections, is clearly a different species, belonging to Planchon and Triana's section *Heterandra*, with dimorphic stamens in the staminate flowers and the staminodia connate into a ring or collar in the pistillate ones.

Representative specimens. COSTA RICA. **Guanacaste:** Parque Nacional Rincón de La Vieja, 950–1100 m, Nov. 1987 (fr), *Herrera 1446* (CR); Cantón de Tilarán, 1–2 km W of Lago Cote, 800–900 m, Aug. 1993 (fl), *Haber & Zuchowski 11626* (CR, MO). **Puntarenas:** Reserva Monteverde, Vert. Pacific, 1520–1580 m, Sep. 1976 (fl), *Dryer 757* (CR). **Alajuela:** La Palma de San Ramón, 1250 m, Nov. 1925 (fl), *Brenes 4600* (385) (CR). **Heredia:** Horquetas de Sarapiquí, Reserva Rara Avis, 700 m, July 1995 (fr), *Martén 1008* (CR). **San José:** Braulio Carrillo National Park, vicinity of Estación Carrillo, 600 m, July 1985 (fr), *Hammel & Trainer 14276* (CR, MO). **Cartago:** Cantón de Turrialba, Valle del Reventazón, Grano de Oro, 1100 m, Sep. 1993 (fl), *Campos & Campos 185* (CR, INB, MO). PANAMA. **Bocas del Toro:** road to Chiriquí Grande N of Fortuna Dam, 650–700 m, June 1987 (fl), *McPherson 11130* (MO). **Chiriquí:** in forest along road to La Fortuna, 1400 m, Feb. 1979 (fl), *Hammel 6232* (MO); ridge road at Cerro Colorado, 1450–1750 m, Aug. 1977 (fl, fr), *Folsom et al. 4832* (MO); **Veraguas:** above Santa Fe beyond Escuela Agrícola Interamericana, Apr. 1976 (fr), *Croat 34216* (MO).

Chrysochlamys silvicola (Hammel) Hammel, comb. nov. Basionym: *Tovomitopsis silvicola* Hammel, Selbyana 9: 113. 1986. TYPE: Costa Rica. Heredia: La Selva Biological Station [ca. 100 m], *Hammel 9404* (holotype, DUKE; isotypes, CR, F, MO).

Shrubs or trees 3–6 m; resin white. Leaf blades oblong-elliptic (13–)16–22 × 4–7(–8) cm, the apex acute to acuminate, the base acute, both surfaces dull, drying reddish tan; major lateral veins 0.5–2 cm apart, ca. 10–16 pairs, difficult to distinguish from the intersecondary veins, fading to the margin where indistinctly loop-connected; petiole 1–2.5 cm. Inflorescence 5–10 cm, ± pendent, minutely pubescent or glabrous; flower buds ca. 4–5 mm, outer 2 sepals often markedly unequal with the larger one ± overtopping the bud; stamens 20–30, anthers of stamens and staminodia about as long as wide, < 1 mm; stigmas ± reflexed. Fruits ovoid to globose, 1.5–2.5 cm, red throughout or whitish at base; calyx ± persistent in fruit.

Distribution. Very wet, primary lowland forest, Caribbean slope, from near sea level to 700(–900) m; Costa Rica and Panama.

This species, particularly as to its type, can be characterized by its primary lateral veins and intersecondaries being almost equally salient. Nevertheless, a few collections from Costa Rica included here (Heredia, Cantón de Sarapiquí, Rara Avis, 400–700 m, *Martén 948* (CR), *G. Vargas 1650* (CR), *O. Vargas 2* (CR), *O. Vargas 4* (CR)) have fewer and less prominent intersecondaries. Material from Panama appears to grade imperceptibly into an extreme with the intersecondaries very obscure. All the material has dull, yellowish to reddish-tan-drying leaves, the outer pair of sepals often very unequal, the petals usually without obvious resin canals, and stamens about 20–30. At least in Costa Rica, the resin of the twigs is bright white, rather than clear or tardily creamy as in most other species in Central America. For its reddish-tan-drying leaves, this species sometimes resembles the more

northern *C. guatemaltecana*, which has more stamens and shiny leaves with fewer, more distant veins.

Representative specimens. COSTA RICA. **Alajuela:** Cantón de San Carlos, (near) Boca Tapada, Finca La Monalisa, 100 m, May 1995 (fl), *Rodríguez & Estrada 702* (CR, INB, MO). **Heredia:** between Río Peje & Río Sardinalito, Caribbean slope of Volcán Barva, 700–750 m, Apr. 1986 (fr), *Grayum 6695* (MO); Finca La Selva, Puerto Viejo de Sarapiquí (ca. 100 m), July 1979 (fl, fr), *Grayum 1902* (CR, DUKE). **San José:** Parque Nacional Braulio Carrillo, Carillo, 600 m, May 1982 (fl), *Gómez-Laurito 8440* (CR). **Limón:** Ref. Nac. Barra del Colorado, forests and pastures between Chirripocito and Río Sardina, 12 m, Apr. 1990 (fr), *Grayum 9794* (CR, F, MO); La Aurora, Guácima, ca. 5 km al E del pueblo, 100 m, Aug. 1988 (fl), *Robles et al. 2087* (CR, F, MO); Cantón de Talamanca, Alto Urén, 700–900 m, Sep. 1994 (fr), *Gallardo & Lépiz 313* (CR, F, INB, MO). PANAMA. **Veraguas:** NW of Santa Fe, 1 km from Escuela Agrícola Alto de Piedra, Feb. 1975 (fl), *Mori & Kallunki 4794* (MO), 900–1200 m, May 1981 (fr), *Sytsma & Andersson 4640* (MO). **Coclé:** El Copé, 1200 m, June 1979 (fr), *Antonio 1189* (MO); N of Penonomé on road to Coclesito, 100–170 m, Feb. 1978 (fl), *Hammel 1681* (MO). **Panamá:** between Cerro Azul and Cerro Jefe, July 1969 (fl), *Foster 1157* (MO); El Llano–Cartí Road, 400–450 m, Jan. 1974 (fl), *Nee & Dressler 9352* (MO), 350–400 m, Feb. 1973 (fr), *Kennedy 2543* (MO). **San Blas:** Río Diablo y vecindad de Duque Sui, 80–110 m, July 1992 (fl), *Herrera et al. 1174* (MO). **Darién:** vicinity of upper gold mining camp of Tyler Kittredge on headwaters of Río Tuquesa, Aug. 1974 (fr), *Croat 27209* (MO).

Chrysochlamys skutchii Hammel, sp. nov. TYPE: Costa Rica. San José: basin of El General, 675–900 m, Mar. 1940 (fl), *Alexander Skutch 4759* (holotype, CR; isotype, MO). Figure 1.

Altitudo altior *C. allenii* affinis a qua differt foliis majoribus, tenuioribus, par extimus sepala inaequalia, calyx ad maturitatem fructus persistens et inflorescentia glabra.

Trees or shrubs 2–10 m; resin clear to creamy (red?). Leaf blades membranaceous, elliptic, (17–)21–35 × 6–12 cm, the apex and base acute to acuminate; lateral veins ca. 1–2 cm apart, ca. 10–17 pairs, mostly reaching to the margin or the apical veins looping into a ± distinct, submarginal vein; petiole 2–4 cm. Inflorescence 7–15 cm, erect, glabrous; flower buds ca. 5 mm, outer pair of sepals very unequal, one < ½ the length of the bud, the other ± equal to the bud; petals membranaceous, lacking distinctly contrasting resin canals; stamens ca. 50, varying in length centripetally, 1–4 mm, the anthers nearly as wide as long, ca. 0.3 × 0.4 mm; stigmas sessile, spreading or slightly elevated. Fruits ± pyriform or obovate, 2.5–4 cm, pale green-pink to red; seeds ca. 1 cm, the aril orange; calyx ± persistent in fruit.

Distribution. This species is known only from a few collections from relatively low 100–750(–900) m elevations in wet forest on the Pacific slope of southern (and eastern) Costa Rica, from the regions of Acosta (Fila Bustamante), Valle del General, the Osa Peninsula and vicinity.

Flowering or sterile collections of this species may be difficult to separate from *Chrysochlamys grandifolia*, a species most readily distinguished by its strongly ribbed fruits. The two grow sympatrically and have been confused on Costa Rica's Osa Peninsula. However, the leaves of *C. grandifolia* usually have a more distinct submarginal vein, it has fewer stamens, and the anthers are often 2–3 times longer than wide rather than about as long as wide. In many details, e.g., fruit shape and color, number and size of stamens, and leaf coloration, *C. skutchii* comes much closer to *C. allenii*. *Chrysochlamys skutchii* is distinguished from *C. allenii* by its larger, thinner leaves, glabrous inflorescence, unequal outer sepal pair, persistent sepals in fruit, and lower-elevation habitat. The epithet is in honor of the first collector of the species, one of Costa Rica's premier natural historians, Alexander Skutch.

Paratypes. COSTA RICA. **Puntarenas:** Cantón de Golfito, La Gamba, "Bosque de los Austriacos," 300 m, Dec. 1993 (fl), *Huber & Weissenhofer 68* (MO), (fl), *Huber & Weissenhofer 90* (CR), (st.), *Huber & Weissenhofer 94* (CR); Cantón de Osa, Parque Nacional Corcovado, Cerro Brujo, 600 m, Jan. 1991 (fl), *Castro 268* (MO); Cerro Rincón, 745 m, Aug. 1990 (fr), *Morales et al. 20* (CR, MO); Cerro Mueller, 150–650 m, May 1988 (fr), *Kernan & Phillips 474* (CR, MO); Estación Los Patos, 250 m, May 1995 (fr), *Moraga 191* (CR, MO), 500 m, July 1988 (fr), *Kernan & Phillips 662* (CR); Los Planes, La Gloria, 170 m, Feb. 1991 (fr), *Induni 266* (CR, INB, MO), 100 m, Feb. 1991 (fr), *R. González 32* (CR); Rincón, Fila Casa Loma, 50–400 m, July 1990 (fr), *Chacón 941* (CR, MO); Camino de Altura, 100–300 m, Aug. 1967 (fr), *Raven 21512* (MO); Aguabuena, 3.5 km W of Rincón, 450 m, Nov. 1992 (fl), *Thomsen 188* (CR); Rancho Quemado, 500 m, Nov. 1991 (fl), *Marín et al. 256* (MO), 300–400 m, May 1988 (fr), *Hammel et al. 16898* (CR, MO), 200–350 m, Apr. 1993 (fr), *Aguilar 1771* (CR, INB, MO).

Chrysochlamys tenuifolia Cuatrecasas, Revista Acad. Colomb. Ci. Exact. 29: 59. 1950. TYPE: Ecuador. Río San Miguel o Sucumbíos, 250 m, *Cuatrecasas 10880* (holotype, F; isotype, COL).

Shrubs or small trees to 2.5–7 m, most twigs with paired bud-scale scars just above the node; resin yellow to orange. Leaf blades elliptic, 8–14(–24) × 3–4.5(–9) cm, the apex acuminate, the base acute to obtuse, drying gray-green; major lateral veins ca. 3(–20) mm apart, ca. (12–)16 prominent pairs but with several nearly equally prominent intersecon-

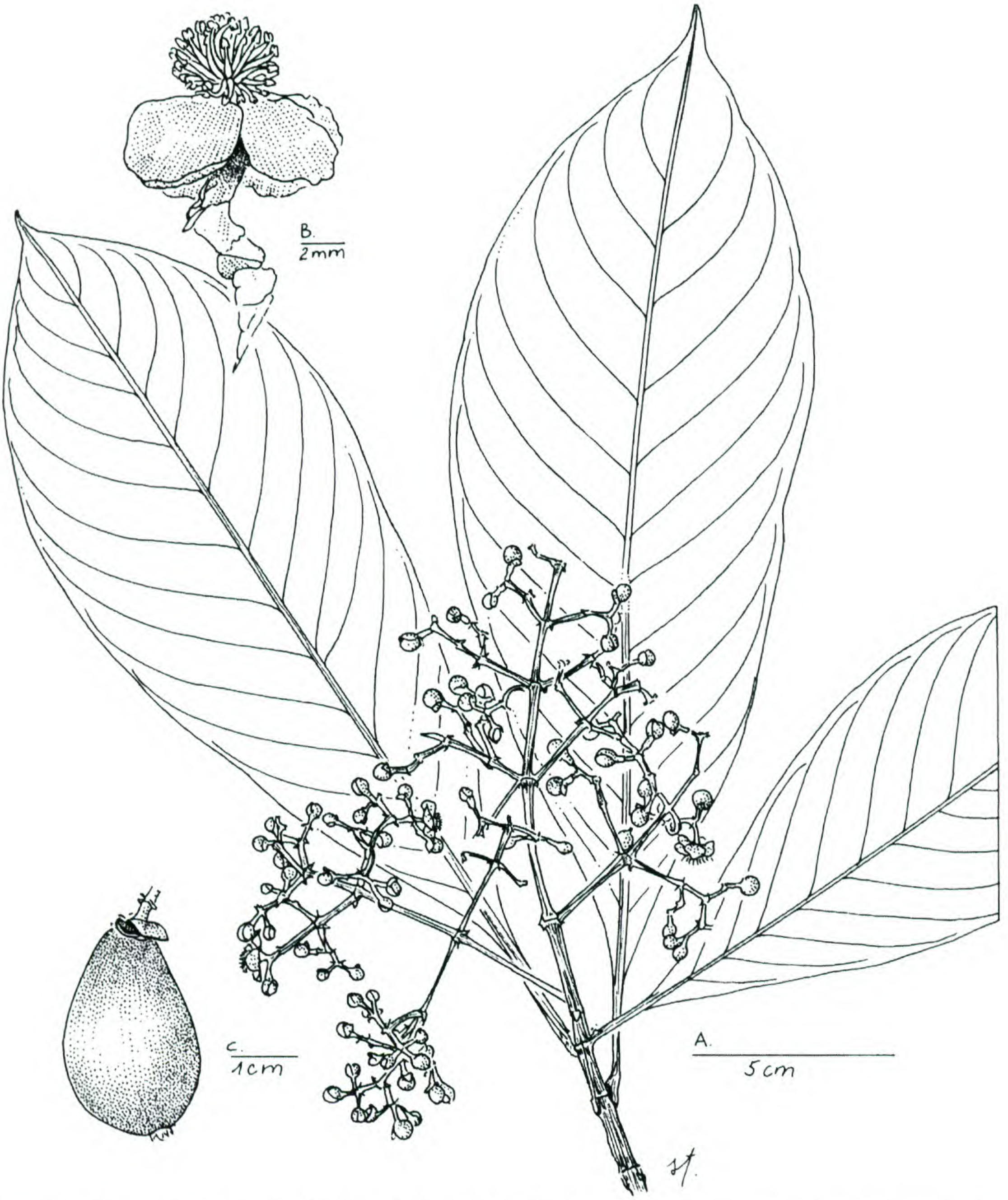

Figure 1. *Chrysochlamys skutchii* Hammel (A, B, *Skutch 4759*; C, *Aguilar 1771*). —A. Flowering branch. —B. Staminate flower. —C. Fruit.

daries, fading to the margin or looping to an obscure submarginal vein; petiole 0.6–1.2 cm. Inflorescence appearing axillary or terminal, 1–3 cm, erect, glabrous; flower buds 2–3 mm, the outer 2 sepals ⅓ the length of the bud; stamens ca. 60, apparently without filaments, anthers of stamens and staminodia broader than long, < 0.5 mm, surmounting a resiniferous capitulum. Fruits ellipsoid-falcate, bean-shaped, red, 1.5–2.5 cm, 3-valved but usually just 1-seeded, the seed black or brown with an orange aril; sepals persistent in fruit.

Distribution. Very wet forest; 300–1400 m. Eastern Panama, Colombia, Ecuador.

Because of its apparently axillary inflorescences, bud-scale scars, and resin-producing staminate

flowers, *C. tenuifolia*'s position in *Chrysochlamys* is somewhat dubious. It has many close and very prominent lateral veins, and small, essentially terminal inflorescences that are often left in an apparently axillary position (only one per node) by the dominant axillary vegetative shoot. It also sometimes has unambiguously terminal inflorescences, and has an androecium with the stamens more or less connivent into an apparently resiniferous capitulum, much as in the resin-producing flowers of some species of *Clusia*. The staminodia of the pistillate flowers are connate into a ring or collar around the base of the ovary as in *Chrysochlamys membranacea*. The small, narrowly ellipsoid-falcate, capsulate fruits mostly have only three sessile stigmas, and usually one seed with a markedly cellular aril. In leaf venation and bud scales it is very similar to *Symphonia*, but for numerous reasons would be even more out of place there than in *Chrysochlamys*. The species must certainly belong to the *Tovomita* group, but further study is in order. Although D'Arcy (1980) created the combination *Tovomitopsis micrantha* (Engler) D'Arcy for this material, the Peruvian *Chrysochlamys micrantha* Engler, by its original description and type photo, bears no resemblance to it.

Representative specimens. PANAMA. **San Blas:** forest SE of Puerto Obaldia, Aug. 1971 (fr), *Croat 16754* (MO); mountains above Puerto Obaldia, Aug. 1971 (fr), *Gentry 1487* (MO). **Darién:** Cerro Mali on Colombian border, 1400–1500 m, Jan. 1975 (fr), *Gentry & Mori 13806* (MO); Parque Nacional del Darién, ridge between Río Topalisa and Río Pucuro, ca. 17 km E of Pucuro, 600–850 m, Oct. 1987 (fr), *de Nevers et al. 8343* (MO), (fl), *Hammel et al. 16379* (MO), 700–1400 m, Oct. 1987 (fl, fr), *Hammel et al. 16357* (MO); Río Tacarcuna, vicinity of old Tacarcuna village, 580 m, Jan. 1975 (fl), *Gentry & Mori 13586* (MO).

Chrysochlamys tenuis Hammel, sp. nov. TYPE: Costa Rica. Limón: Cordillera de Talamanca, Fila Matama, 09°47′18″N, 83°08′45″W, 1350 m, Apr. 1989 (staminate fl), *G. Herrera & A. Chacón 2673* (holotype, CR; isotypes, MO (2)). Figure 2.

Chrysochlamys glauca affinis a qua differt foliis angustioribus et plerumque in sicco ferruginis vice glaucorum, venatione magis inconspicuo, inflorescentia tenuiore.

Shrubs or small trees 2–5 m; resin clear to tardily creamy. Petiole 0.5–2 cm. Leaf blades narrowly elliptic, 5–13 × 1–2.5(–3.5) cm, the apex acuminate, the base narrowly acute and shortly decurrent, both surfaces dull, drying reddish tan to gray-green; lateral veins ca. 0.5 cm apart, 6–8 pairs, very indistinct, often difficult to distinguish from intersecondaries, fading to the margin or looping to form an obscure submarginal vein; resin canals usually very obscure, ± parallel to the midrib or at least somewhere crossing the lateral veins. Inflorescence paniculate, very lax to slightly congested, ± globose, ca. 2–5(–8) cm long, 3- to ca. 30-flowered, the rachis very slender, often deflexed or pendulous, glabrous; flower buds 3–4 mm long, usually conspicuously striate with resin canals; outer 2 sepals ± equal and shorter than the bud, sometimes very narrowly triangular, rarely (in the type and one nearby paratype, *Herrera 2495*) the third and fourth sepals long-acuminate with the filiform tips overtopping the rest of the bud by ca. 2 mm; petals membranaceous; stamens ca. 20, free, 2–2.5 mm long, the anthers ± globose, ca. 0.3 mm long; stigmas 5. Fruits narrowly obovoid to pyriform, usually rostrate, 2–3 cm long, reddish, often tinged with white or pale yellow, 1–3-seeded; seeds with an orange aril; calyx deciduous in fruit.

Distribution. This species is known from scattered localities in very wet forest on the Atlantic slope of Costa Rica and Panama, and from a few collections from wet forest on the Burica Peninsula, shared by both countries along their Pacific border. Although most material is from below 800 m, the type is from nearly 1400 m.

The type and all other Costa Rican, Atlantic slope collections, as well as one Panamanian collection from Bocas del Toro (*Kirkbride & Duke 621*), one from Veraguas (*McPherson 10724*), and two from the Río Blanco de Norte area of the Atlantic lowlands of Coclé, have particularly long, narrow leaves without obvious intersecondaries and relatively few-flowered, very lax inflorescences with the outer sepals slightly to very narrowly triangular. The Burica Peninsula outliers and all other collections from Panama tend to have somewhat broader and shorter leaves with more obvious intersecondaries, multi-flowered, more congested inflorescences, and broader outer sepals.

Chrysochlamys tenuis is similar to *C. glauca* in its dull, few-veined leaves and small flower buds. The Río Guanche and Cerro Campana populations cited here were discussed by D'Arcy (1980: 1034) under that species as "suggestive of a distinct variety or even species." Rather than further blurring what then seemed only suggestive evidence, more recent collections, particularly those from Atlantic Costa Rica, strengthen the case for recognizing this entity as a distinct species. Other than the narrower and usually reddish tan vs. gray-green-drying leaves, more obscure venation, and smaller, more delicate inflorescences, *C. tenuis* is distinguished from *C. glauca* by the resin canals of the leaves,

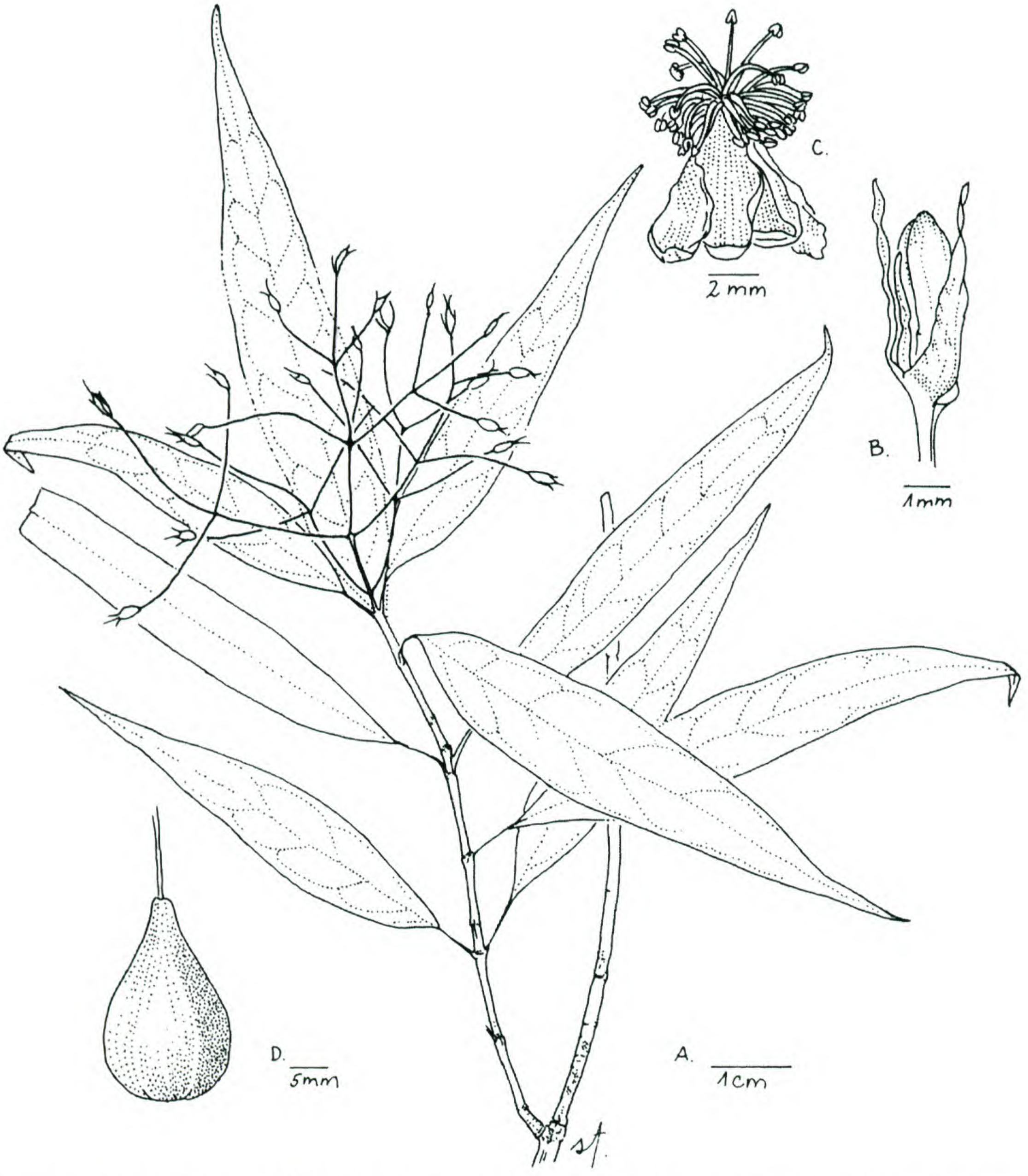

Figure 2. *Chrysochlamys tenuis* Hammel (A–C, *Herrera & Chacón 2673*, D, *Berrocal et al. 74*). —A. Flowering branch. —B. Flower bud. —C. Staminate flower. —D. Fruit.

which, when visible, are more or less parallel to the midrib or at least somewhere crossing the lateral veins, rather than parallel to the lateral veins, as in *C. glauca* and most other species. The narrowly obovoid fruits of *C. tenuis* are usually only 1- or 2-seeded, whereas the more or less globose or broadly obovoid fruits of *C. glauca* are normally 5-seeded. *Mori et al. 3950* recorded the seeds as "steel blue." The new species also superficially resembles the Panamanian *C. angustifolia*, which, however, is an epipetric rheophyte with milky resin, stouter inflorescence axes, and much larger flower buds.

Original field notes for the type of this species indicated four duplicates. These were earlier distributed as either *Tovomitopsis angustifolia* or *T. glauca*, and their whereabouts, except as indicated above, are uncertain.

Paratypes. COSTA RICA. **Limón:** Cordillera de Talamanca, Fila Matama, Cerro Muchilla, 850 m, Apr. 1989 (fr), *Robles & Chacón 2678* (CR, MO); Reserva Biol. Hitoy

Cerere, Cerro Bitárkara, 800 m, Feb. 1989 (fl bud), *Herrera & Solís 2495* (CR, MO); Río Tercero, 600 m, May 1985 (fr), *Berrocal et al. 74* (CR); Suretka, 200 m, July 1982 (fr), *Gómez-Laurito 8839* (CR). **Puntarenas:** Burica Peninsula, Punta Burica, *M. M. Chavarría 306 et al.* (CR, INB). PANAMA. **Chiriquí:** Burica Peninsula, 8–11 mi. W of Puerto Armuelles, 200–500 m, Feb. 1973 (fl, fr), *Croat 21995* (MO), Mar. 1973 (fl, fr), *Croat 22472* (MO); La Fortuna hydroelectric project, 1200 m, Mar. 1978 (fl, fr), *Hammel 2181* (MO). **Bocas del Toro:** Quebrada Huron on Cerro Bonyic, 170–400 m, Apr. 1968 (fr), *Kirkbride & Duke 621* (MO); Chiriquicito–Calderas trail, Apr. 1968 (fr), *Kirkbride & Duke 765* (MO). **Veraguas:** Escuela Agrícola Alto de Piedra, road to Calovébora, 450–550 m, Aug. 1974 (fr), *Croat 27665* (MO), Nov. 1974 (fr), *Mori & Kallunki 3224* (MO), Dec. 1974 (fr), *Mori et al. 3950* (MO); slopes of Cerro Tute, 600–750 m, Mar. 1987 (fl), *McPherson 10724* (MO). **Coclé:** above El Copé, ca. 700–900 m, Apr. 1977 (fr), *Folsom & Robinson 2371* (MO), Apr. 1977 (fr), *Folsom & Kauke 2652* (MO), Oct. 1977 (fr), *Folsom et al. 5707* (MO), Nov. 1977 (fr), *Folsom & Collins 6516* (MO), Jan. 1978 (fr), *Hammel 953* (MO), Apr. 1978 (fr), *Hammel 2432* (MO), June 1978 (fr), *Hammel 3587* (MO), Jan. 1989 (fr), *McPherson 13627* (MO); Atlantic slope from El Copé to Río Blanco del Norte, ca. 150 m, Feb. 1980 (fl, fr), *Antonio 3653* (MO), 350 m, Feb. 1982 (fl), *Knapp 3675* (MO); near El Valle, ca. 700–1000 m, Aug. 1967 (fr), *Duke & Dwyer 13936* (MO), Jan. 1972 (fr), *Gentry & Dwyer 3654* (MO), Dec. 1972 (fr), *Gentry 6848* (MO), Sep. 1978 (fr), *Hammel 4794* (MO), May 1967 (fl), *Lewis et al. 1769* (MO), *1785* (MO), Nov. 1974 (fr), *Mori & Kallunki 2960* (MO), June 1975 (fl), *Mori et al. 6565* (MO). **Panamá:** Cerro Campana, ca. 900 m, May 1971 (fl), *Croat 14681* (MO), *14753* (MO), Sep. 1982 (fr), *D'Arcy 15071* (MO), Mar. 1969 (fl), *Porter et al. 4259* (MO); Cerro Trinidad, 800–1000 m, Oct. 1946 (fr), *Allen 3773* (MO); El Llano–Cartí Road, Feb. 1977 (fl, fr), *Foster 2770* (MO). **Colón:** Santa Rita Ridge, Jan. 1968 (fl), *Dwyer 8564* (MO); Río Escandaloso near Cerro Bruja, 10–200 m, Apr. 1978 (fl), *Hammel 2672* (MO), *2713* (MO), Mar. 1982 (fl), *Knapp & Kress 4283* (MO), (fr), *Knapp et al. 4461* (MO); Río Guanche near Portobelo, ca. 0–100 m, May 1984 (fl, fr), *Churchill 5119* (MO), Oct. 1978 (fr), Dec. 1973 (fl), *Gentry 8764* (MO), Oct. 1978 (fr), *Hammel et al. 4932* (MO), July 1971 (fl), *Kennedy 1174* (MO), Jan. 1973 (fr), *Kennedy & Foster 2132* (MO), Aug. 1981 (fr), *Knapp 1024* (MO), Mar. 1975 (fr), *Mori & Kallunki 5194* (MO), Mar. 1975 (fl), *5212* (MO), June 1975 (fl), *Mori et al. 6443* (MO), Aug. 1975 (fr), *Mori & Witherspoon 7955* (MO), Dec. 1973 (fr), *Nee & Gentry 8719* (MO), July 1976 (fr), *Sullivan 155* (MO), Oct. 1980 (fr), *Sytsma 1645* (MO).

Extralimital Species

Although the strictly South American *Balboa* does not occur within the geographic focus of this paper, taxonomic clarity and logical consistency prescribe its mention here as an additional synonym of *Chrysochlamys*. Planchon and Triana described the genus and its single species, *B. membranacea*, based only on staminate material and placed it in their subtribe "Euclusieae" rather than Tovomiteae. Examination of type material and more recent collections, of both staminate and pistillate plants (e.g., *Boyle & Boyle 3303* (MO), *Croat 73004* (MO), *Gentry et al. 14655* (MO), *Hammel & Trainer 15831* (MO), *Hoover 1287* (MO), *Hoover et al. 3136* (MO), *Romero-Castañeda 2739* (COL), *Rubio & Quelal 1339* (MO)) support the view that *B. membranacea* is a species of *Chrysochlamys*:

Chrysochlamys balboa Hammel, nom. nov. Basionym: *Balboa membranacea* Planchon & Triana, Ann. Sci. Nat. Bot., sér. 4. 14: 252. 1860, non *C. membranacea* Planchon & Triana, 1860. TYPE: Colombia. Between Tuquerres and Barbacoa, 1176 m, Apr. 1853, *Triana s.n.* (holotype, P; isotype, COL).

Excluded Species

Chrysochlamys clusiifolia subsp. *panamensis* Maguire, Phytologia 36: 395. 1977. TYPE: Panama. Darién: Cerro Mai, Serranía del Darién, *Gentry & Mori 13769* (holotype, MO) = *Dystovomita paniculata* (J. D. Smith) Hammel, Ann. Missouri Bot. Gard. 76: 927. 1989.

D'Arcy (1980) already showed this to belong in his newly elevated genus, *Dystovomita*.

Tovomitopsis membranifolia (Standley) D'Arcy, Ann. Missouri Bot. Gard. 67: 1035. 1980. *Tovomita membranifolia* Standley, Field Mus. Nat. Hist. Bot. Ser. 22: 160. 1940. TYPE: Panama. Darién: Caná–Cuasí trail, Chepigana District, *Terry & Terry 1478* (holotype, F; isotype, MO) = *Tovomita stylosa* Hemsley, Biol. Cent.-Amer. 1: 88. 1879.

Hammel (1986) already showed this to be a synonym of *Tovomita stylosa*.

Tovomita croatii Maguire, Phytologia 36: 404. 1977. *Tovomitopsis croatii* (Maguire) D'Arcy, Ann. Missouri Bot. Gard. 67: 1031. 1980. TYPE: Panama. Veraguas: road to Calovébora, *Croat 14268A* (holotype, MO).

Shrubs 1–2 m, resin clear. Leaf blades obovate, widest above the middle, 20–60 × 7–25 cm, the apex acuminate, the base narrowing to an acute or cordulate base; lateral veins ca. 1–2 cm apart, ca. 16–22 pairs, looping to form a distinct submarginal vein 2–5 mm from the margin; petiole lacking. Inflorescence 10–26 cm, usually pendulous, glabrous or puberulent; flower buds ca. 6 mm, the outer sepals often overtopping the inner; stamens 25–30, anthers of both stamens and staminodia about twice as long as wide, ca. 1.5 mm; stigmas concave and spreading. Fruits pyriform, green to pink, ca. 2 cm; seeds ca. 1 cm; calyx ± persistent in fruit.

Distribution. Very wet, mostly lowland forest, 30–350(–1500) m; Costa Rica, Panama, Ecuador.

This rare, somewhat problematic species might appear to walk the generic borderline between

Chrysochlamys and *Tovomita*. The outer pair of sepals, although thinly membranaceous, exceed the bud as in *Tovomita*, yet styles are lacking and the fruits apparently do not have the dark maroon placenta and inner fruit wall typical of *Tovomita*. Nevertheless, two Costa Rican collections (*Grayum 3374*, *Grayum & Schatz 5276*) clearly indicate the presence of side shoots with clustered leaves. With present knowledge, placement of this species in *Tovomita*, particularly because of its branching pattern, is more justifiable than placement in *Chrysochlamys*. As a species, it is very distinctive, not only for the nearly sessile and sometimes very large leaves, but also for the numerous (16–22) lateral veins that are loop-connected to a distinct submarginal vein. Probably because of the rarity of this species, its short stature, and large leaves, the typical *Tovomita* branching pattern of *T. croatii* has gone unobserved and unrecorded.

Representative specimens. COSTA RICA. **Limón:** Reserva Biol. Hitoy Cerere, 90–200 m, July 1985 (fr), *Grayum & Hammel 5763* (CR, MO); Cantón de Talamanca, Sukut, 350 m, July 1989 (fr), *Herrera 3168* (CR, MO); Finca Anai, W of Mata de Limón (Sixaola region), 30 m, May 1985 (fl), *Grayum & Schatz 5276* (CR, MO). PANAMA. **Chiriquí:** Fortuna Dam Area, 1100 m, May 1984 (fl), *Churchill 5243* (MO). **Coclé:** El Valle, Cerro Gaital, 900–1000 m, July 1968 (fl, fr), *Dwyer & Correa 8913* (MO). ECUADOR. **Pichincha:** Quito a Sto. Domingo de los Colorados, km 94, 1300–1500 m, Dec. 1986 (fr), *Zak 1529* (MO).

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A New Name for a Common Ecuadorian and Peruvian Wild Tomato Species

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ABSTRACT. The new name *Solanum habrochaites* S. Knapp & D. M. Spooner is coined to replace the homonym *Solanum agrimoniifolium* (Dunal) J. F. Macbride, which has been used for the wild tomato species known in *Lycopersicon* as *Lycopersicon hirsutum* Dunal.

While preparing the Solanaceae for the *Catalogue of the Vascular Plants of Ecuador* (Jørgensen & León-Yánez, 1999), we discovered that a new name was necessary for the common wild tomato species previously known as *Lycopersicon hirsutum*. We accept species of tomatoes in the genus *Solanum* following molecular and morphological studies of Child (1990), Spooner et al. (1993), Bohs and Olmstead (1997), and Olmstead and Palmer (1997). Spooner et al. (1993) provided a compilation of names and combinations in *Solanum* for all nine taxa of tomatoes recognized by Rick et al. (1990). The epithet *hirsutum* is not available for this taxon in *Solanum*, as it is occupied by *Solanum hirsutum* Dunal (1816), and the pre-existing combination used by Spooner et al. (1993), *Solanum agrimoniifolium* (Dunal) J. F. Macbride, for *L. hirsutum* is a later homonym of an epithet already published in *Solanum*. A new epithet in *Solanum* is therefore necessary for this taxon.

Solanum habrochaites S. Knapp & D. M. Spooner, nom. nov. Replaced name: *Lycopersicon hirsutum* Dunal, Solanorum synopsis 4. 1816, non *L. hirsutum* Dunal, in DC., Prodromus 13(1): 24. 1852. TYPE: Ecuador. Loja: "Hab. in agris Peruvianis prope Loxa," *Humboldt & Bonpland s.n.* (holotype, P). Locality for type collection fide Kunth (Humboldt et al., 1818), "Crescit prope Loxa Novo-Granatensium, alt. 1060 hex."

Solanum agrimoniifolium (Dunal) J. F. Macbride, Field Mus. Nat. Hist., Bot. Ser. 13: 159. 1962. Hom. illeg., non Rydberg, Bull. Torr. Bot. Club 51: 154. 1924. *Lycopersicon agrimoniifolium* Dunal, in DC., Prodromus 13(1): 24. 1852; "*agrimoniaefolium*." TYPE: Peru. Sin. loc., *Pavón s.n.* (holotype, G not seen).

Both Dunal's and Rydberg's spellings of the epithet *agrimoniifolium* are errors to be corrected under Article 60.8 of the *Code* (Greuter et al., 1994). The new specific epithet is derived from the Greek, *habro* = soft, delicate, and *chaites* = haired, thus retaining as closely as possible Dunal's original intention.

Dunal (1816) stated that he saw the specimen he named *Lycopersicon hirsutum* in the Humboldt and Bonpland herbarium ("v.s.h. H et B."), but a specimen of this taxon could not be found in P-Bonpl. Kunth (Humboldt et al., 1818) did not see specimens of this taxon while writing his account of Humboldt and Bonpland's plants, "Specimena hujus et praecedentis speciei haud vidi." No specimen identifiable as this taxon and collected by Humboldt and Bonpland is present in the Willdenow herbarium (microfiche edition IDC). Dunal had intended to publish an illustrated edition of his *Solanorum synopsis* (1816), and to that end had a series of drawings of the taxa described therein prepared by the artist Node-Veran, to which he referred in *Solanorum synopsis* (Dunal, 1816). These drawings are held in the collections at Montpellier (MPU), and in the set is a plate of *Lycopersicon hirsutum* (Fig. 1B). A specimen in the general herbarium at P collected by Humboldt and Bonpland and annotated by Dunal that is a perfect match for this drawing is clearly the holotype for this name (Fig. 1). On the specimen are pinned several labels with different descriptions, one of them (far left lower corner) is that of Kunth (Humboldt et al., 1818). On the label in the upper left is written "Solanum dentatum" and a draft description in Dunal's hand. The description, however, does not

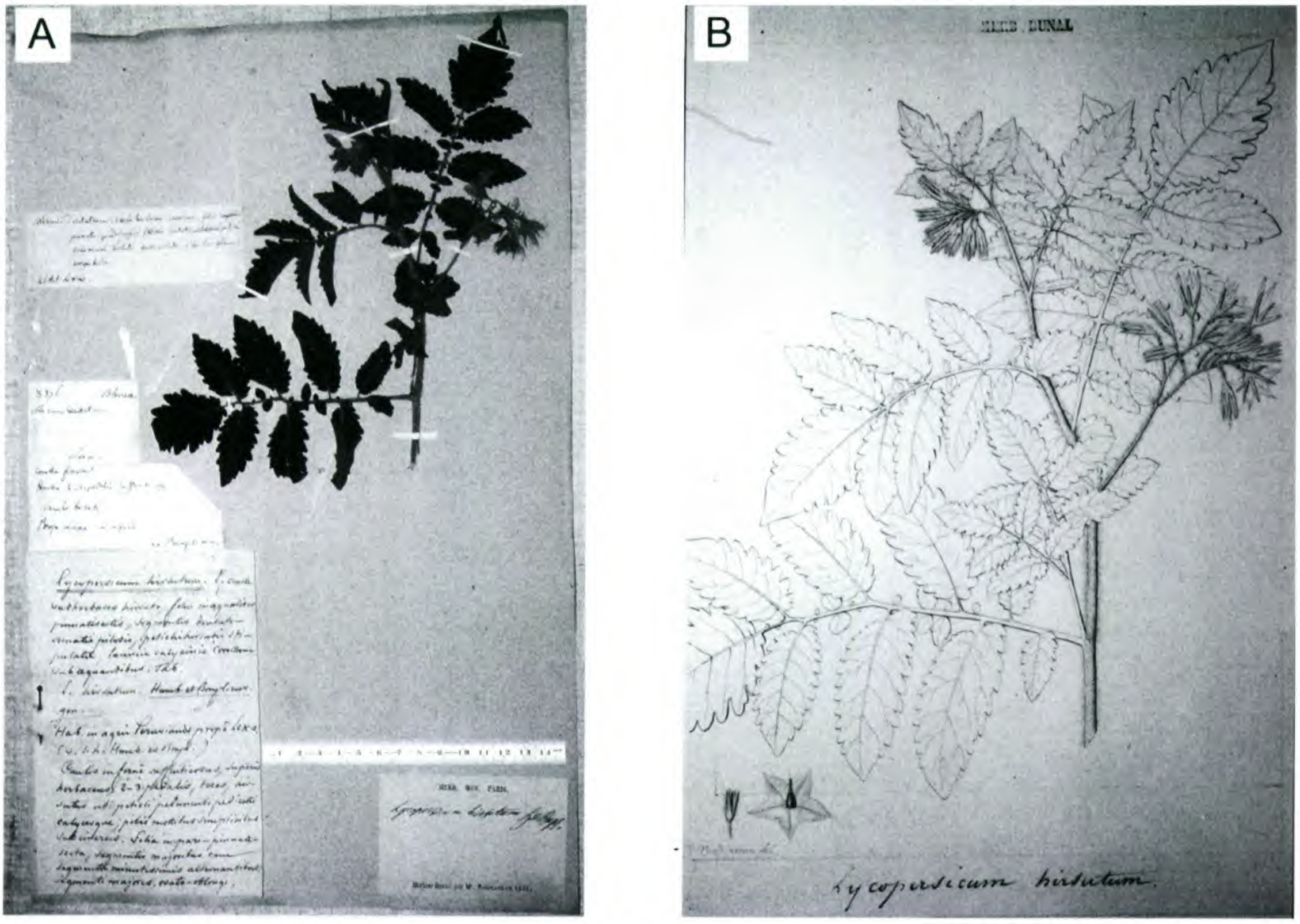

Figure 1. —A. Holotype specimen of *Solanum habrochaites* S. Knapp & D. M. Spooner (*Lycopersicon hirsutum* Dunal) at P. —B. Original drawing of *Lycopersicon hirsutum* Dunal by Node-Veran for Dunal, Solanaceae n° 83 (copyright Université Montpellier II, reproduced with permission: National collections of the herbarium of the Institut de Botanique (MPU)).

match that of *L. hirsutum* in *Solanorum synopsis*, nor does it match that of *L. dentatum* Dunal, also described in the same work (a synonym of *S. peruvianum* L.). To preserve nomenclatural stability, we prefer to coin a new name rather than use an epithet that perhaps was not intended by Dunal for this particular plant.

Acknowledgments. We thank R. K. Brummit of the Royal Botanical Gardens, Kew, for valuable advice and a thorough and careful review, and J. Mathéz of the Institut de Botanique, Montpellier, for permission to reproduce the unpublished Node-Veran drawing.

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A New Species of Deciduous Azalea (*Rhododendron* section *Pentanthera*; Ericaceae) from South Carolina

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ABSTRACT. A new species of deciduous azalea, *Rhododendron eastmanii*, has been discovered in South Carolina, U.S.A. This azalea can be distinguished from the other members of *Rhododendron* sect. *Pentanthera* by its distinctive morphology, flowering time, and fragrance. It is presently known only from Orangeburg and Richland counties.

A new species of *Rhododendron* for South Carolina is recognized based on the diagnosability criterion of Davis and Nixon (1992). The deciduous leaves, narrow corolla tube, and 5 declinate stamens strongly exserted from the corolla place this species in *Rhododendron* sect. *Pentanthera* G. Don. Within the section, 14 species are currently recognized in North America (Kron, 1993). Known from only two localities in South Carolina, *R. eastmanii* presently consists of approximately 500 individuals at each site.

Rhododendron eastmanii Kron & Creel, sp. nov. TYPE: U.S.A. South Carolina: Orangeburg Co., Santee State Park along Limestone Sink hiking trail, 17 May 1993, *Kron 3023* (holotype, WFU; isotypes, MO, USCH, WFU). Figures 1, 2.

Species haec a *Rhododendron arborescens* (Pursh) Torrey differt corolla supra macula aurea, perulis gemmis marginibus glandulosis, ramunculis dense pubescentibus, et floribus fragrantibus.

Shrub or small tree to 5 m tall, non-rhizomatous; young twigs usually reddish brown, densely covered with unicellular and multicellular eglandular hairs. Vegetative bud scales glabrous abaxially; margin unicellular-ciliate. Leaf blade membranaceous, ovate or obovate to elliptic, 4.3–7.1 × 1.8–2.9 cm; base acute to oblique; apex acute to obtuse, mucronate; adaxial surface sparsely to densely covered with unicellular hairs, the midvein densely covered with unicellular hairs, multicellular eglandular hairs sparsely scattered on adaxial surface; abaxial surface moderately to densely covered with unicellular hairs and multicellular eglandular hairs, the midvein densely covered with unicellular hairs and multicellular eglandular hairs, 2° veins occasionally with multicellular eglandular hairs; margin entire, ciliate with multicellular eglandular hairs; petioles 0.25–0.70 cm long, densely covered with unicellular hairs and sparsely to densely covered with multicellular eglandular hairs. Flower bud scales chestnut brown; abaxial surface glabrous; margin unicellular-ciliate near apex, glandular along the lower ⅔ of margins. Flowers appearing after the leaves have expanded; inflorescence a shortened raceme of 5–9 flowers. Pedicels 0.5–1.1 cm long, densely covered with unicellular hairs and sparsely to densely covered with multicellular eglandular hairs, occasionally with multicellular glandular hairs. Sepals 0.05–0.1 cm long, often varying in length on the same flower; margins setose with multicellular eglandular hairs; abaxial surface sparsely to densely covered with unicellular hairs and multicellular eglandular hairs, occasionally with a few weakly glandular multicellular hairs. Corolla white with a yellow blotch on the upper corolla lobe and pink-tinged lobes on newly opened flowers, fragrance strong, fresh, and sweet, the tube longer than the limb and gradually expanding into it; upper corolla lobe 0.9–1.7 × 0.8–1.6 cm; lateral lobes 1.1–2.5 × 0.5–1.1 cm; corolla tube 1.3–2.5 cm long, 0.25–0.35 cm wide at base; outer surface of corolla densely covered with unicellular hairs and sparsely to densely covered with multicellular gland-tipped hairs, the glands usually weakly developed; inner surface of corolla densely covered with unicellular hairs. Stamens 4.5–6.7 cm long, with dense flattened unicellular hairs on proximal 2.3–2.7 cm of filament, exserted 2.2–3.5 cm be-

Figure 1. *Rhododendron eastmanii* Kron & Creel. Photograph by M. Creel.

yond the throat of corolla. Style (3.7–)5.4–6.5 cm long, exserted (1.6–)2.5–4.2 cm beyond the throat of corolla, with dense unicellular hairs on the proximal 0.4–2.0 cm; stigma 0.15–0.25 cm wide. Ovary 0.25–0.35 cm long, 0.15–0.20 cm wide at the base, densely covered with unicellular and multicellular eglandular hairs. Capsules 1.2–1.9 cm long, 0.4–0.8 cm wide at base, sparsely to densely covered with unicellular hairs and multicellular eglandular hairs. Seeds pale to dark chestnut brown, elliptic to fusiform, 2.5–4.0 mm long; testa expanded and dorsiventrally flattened, surrounding the body, the cells elongate with transverse end-walls.

Etymology. The specific epithet honors Charles Eastman of Columbia, South Carolina, who first discovered this species while bird-watching in Santee State Park.

Distribution and ecology. Orangeburg and Richland counties, South Carolina. On north-facing slopes with well-drained, nearly neutral soils, often near limestone. Associated species: *Rhododendron canescens* (Michaux) Sweet, *R. periclymenoides* (Michaux) Shinners, *Stewartia malacodendron* L., *Styrax grandifolia* Aiton, *Oxydendrum arboreum* (L.) DC., *Kalmia latifolia* L., *Fagus grandifolia* Ehrhart, *Quercus* spp., *Liriodendron tulipifera* L., and *Symplocus tinctoria* (L.) L'Héritier. Flowering in early May.

Rhododendron eastmanii is similar in general appearance to *R. occidentale* (Torrey & A. Gray) A. Gray, from which it can be distinguished by its lack of glandular hairs on the leaves and petioles (Fig. 2; Kron, 1993). *Rhododendron eastmanii* is geographically isolated from *R. occidentale*, which occurs from southern California to southern Oregon. Further investigation of the potential relationships of *R. eastmanii* and *R. occidentale* would be an interesting evolutionary study. Among the other white-flowered azaleas of the southeastern United States (i.e., *R. alabamense* Rehder, *R. arborescens* (Pursh) Torrey, *R. atlanticum* (Ashe) Rehder, and *R. viscosum* (L.) Torrey), *Rhododendron eastmanii* can be distinguished from *R. alabamense* by the flowers opening after the leaves have expanded, and from *R. arborescens*, *R. atlanticum*, and *R. viscosum* by the presence of a yellow blotch on the upper corolla lobe (Fig. 1, Table 1). In addition, the densely hairy young twigs found in plants of *R. eastmanii* are lacking in *R. arborescens*. The weakly glandular corolla of *R. eastmanii* is also different

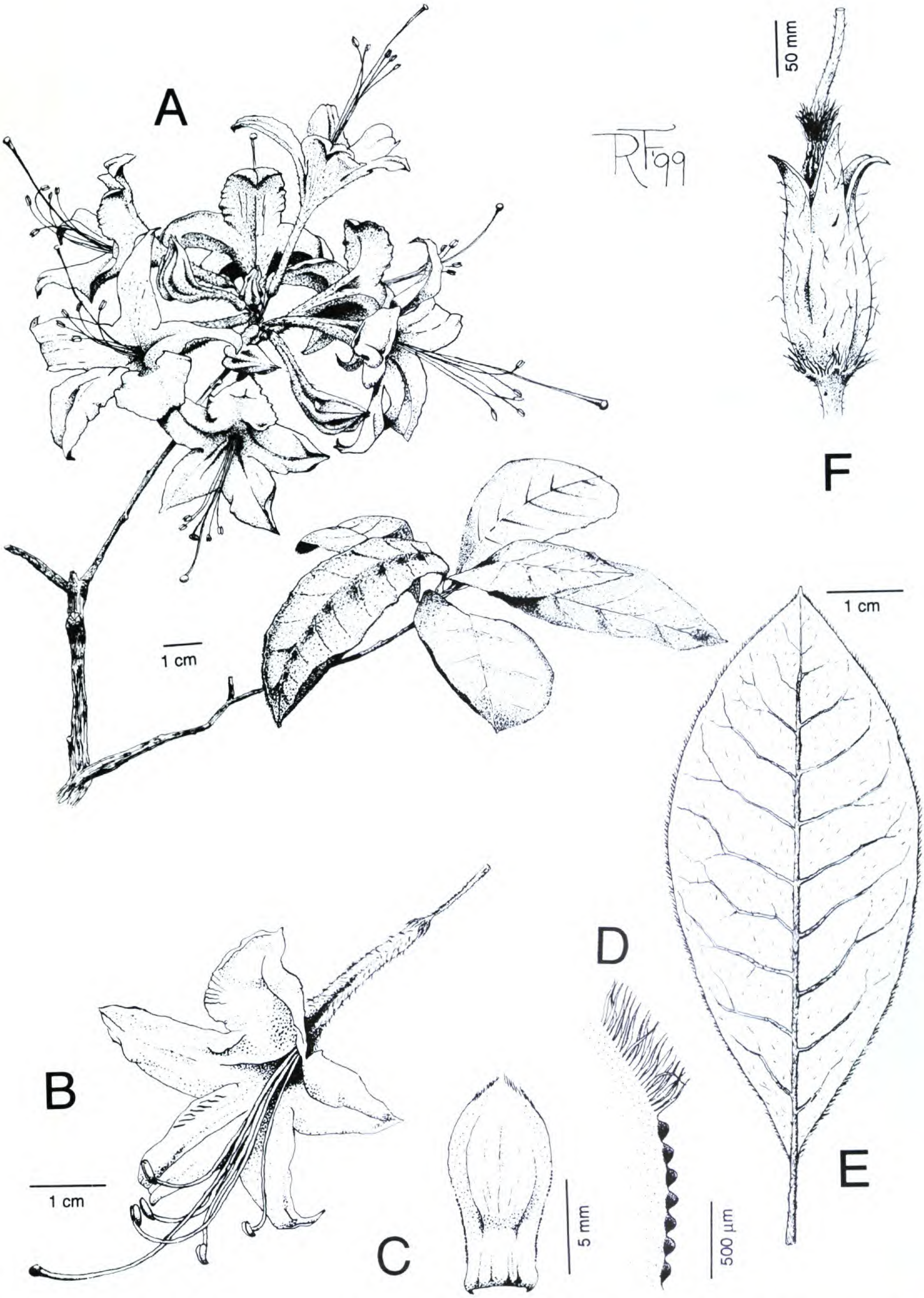

Figure 2. A–F. *Rhododendron eastmanii* (*Kron 3023*). —A. Flowering branch. —B. Flower. —C. Inflorescence bud scale. —D. Close-up of inflorescence bud-scale margin showing glands along lower ⅔. —E. Leaf. —F. Capsule.

Table 1. Distinguishing features of the white-flowered species of *Rhododendron* sect. *Pentanthera*.

Species	Time of flowering relative to leaf expansion	Inflorescence bud scale margin	Yellow blotch on upper corolla lobe	Glandular hairs on leaf margins and petiole
R. eastmanii	after	glandular	present	absent
R. alabamense	before	non-glandular	present	absent
R. arborescens	after	non-glandular	absent	absent
R. atlanticum	before	non-glandular	absent	absent
R. occidentale	variable	variable	present	present
R. viscosum	after	variable	absent	absent

from the very sticky, glandular corolla of *R. viscosum* and *R. atlanticum* (Kron, 1993).

Reports of *R. alabamense* from South Carolina (Radford et al., 1981) may actually refer to *R. eastmanii*. A specimen (i.e., *Ahles 25522*, NCU) identified as *R. alabamense* was seen by the authors. It lacks corolla color information, but in other respects fits *R. eastmanii*. This specimen also has fully expanded leaves at the time of flowering—a characteristic of *R. eastmanii* but not *R. alabamense*. The authors and other field botanists have noted that *R. eastmanii* flowers when no other native azaleas in the area flower, thus potentially suggesting the reproductive isolation of this species from other native azaleas.

Preliminary cladistic analysis of morphological characters (Kron, 1993) for species within *Rhododendron* sect. *Pentanthera* place *R. eastmanii* as closely related to *R. calendulaceum* (Michaux) Torrey and *R. cumberlandense* E. Braun. Although the latter two species possess orange to red corollas, all three share the character of glandular inflorescence bud scales (Fig. 2). Further, more detailed study is necessary to confirm this relationship.

The discovery of a new species of deciduous azalea in South Carolina is unexpected and significant. Although the site of the holotype is within Santee State Park, the only other known population is presently threatened by urban development (Richland Co.). To discourage inappropriate collection by azalea enthusiasts, MC has developed a collection of rooted cuttings that will be made available to the public in the near future.

Paratypes. U.S.A. **South Carolina:** Richland Co., 1 May 1997 *Pittman 05109701* (USCH). Orangeburg Co., Santee State Park, 17 May 1993, *Kron 3021, 3022* (WFU).

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A New *Lobelia* from Mexico, with Additional New Combinations in World Campanulaceae

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ABSTRACT. *Lobelia guerrerensis* is a new species endemic to pine, pine-oak, and mixed deciduous forests of the Sierra Madre del Sur in Guerrero, Mexico. Though collected several times over the past 60 years, the specimens were consistently misidentified as the narrow-leaved phase of *L. laxiflora*. Detailed phenetic analyses, however, have showed them to be morphologically quite distinct. In addition, several new combinations needed for a forthcoming checklist of world Campanulaceae are published.

Work is drawing to a close on a checklist of Campanulaceae s.l. currently recognized in the world's taxonomic literature. Four precursor papers effecting requisite nomenclatural changes (Lammers, 1995, 1998a, 1999) and describing recently detected species (Lammers, 1998b) have already appeared. This is the fifth and (I hope) final installment in that series.

It should be noted that some of the names validated here stem from recent studies conducted under my direction by two students, Michael James Eakes of the University of Illinois and Kari Ellen Morris of the University of Illinois-Chicago. It will not be possible to publish their complete results prior to publication of the checklist. Therefore, nomenclatural innovations dictated by their studies are extracted and published here in advance, so that the resulting names will be available for use in the checklist and elsewhere.

Actions undertaken here are of three types: (1) description of a new species of *Lobelia* L. from Guerrero, Mexico (with a change in rank for a related taxon); (2) new combinations in *Campanula* L., *Centropogon* C. Presl, and *Lobelia*, dictated by the principle of priority; and (3) new combinations for species and subspecies of *Codonopsis* Wallich, *Cyanea* Gaudichaud, *Cyclocodon* Griffith, and *Delissea* Gaudichaud, which do not have a name at that rank in the genus or species to which they are assigned.

NEW SPECIES

Unpublished morphometric studies in *Lobelia* sect. *Homochilus* A. DC. by Eakes (cf. Hamlin, 1995; Eakes & Lammers, 1996) disclosed the existence of a discrete group of specimens from the Mexican state of Guerrero, which did not conform to any previously recognized taxon. These specimens had been collected over the past 60 years by different botanists and widely distributed to the world's herbaria. In every instance, however, they were identified as the narrow-leaved phase of *L. laxiflora* Kunth, a species widespread in Mexico and Central America (see below). It was only with detailed phenetic analyses that the distinctness of these plants was revealed. Because these plants were as distinct morphologically as any species in the section, they are here described as a new species:

Lobelia guerrerensis Eakes & Lammers, sp. nov. TYPE: Mexico. Guerrero: municipio de Atoyac de Alvarez, a 6 km al SO de Puerto del Gallo, bosque mesófilo de montaña, 2320 m, 29 Mar. 1983, *Soto & Martínez 5136* (holotype, MEXU). Figure 1.

A *Lobelia laxiflora* foliis cernuis cum marginibus integris vel subintegris et minute revolutis, corollae tubo flavo vel luteo-aurantiaco et lobis rubris vel aurantiacis, tubo antherarum dense villoso a basi ad summum tecto cum trichomatibus isabellinis 2–4 mm longis, antheris ventralibus apice caespitosis cum trichomatibus isabellinis 1.5–2 mm longis, capsulis 9–11 mm diametro, et seminibus 0.7–0.8 mm longis 0.3–0.4 mm latis differt.

Stems 1–2 m tall, woody or suffruticose, branched or unbranched, erect or ascending, glabrous. Leaves sessile, glabrous; lamina linear or lanceolate, 7–18 cm long, 0.3–1.1 cm wide, cernuous, chartaceous; margin entire or sometimes with a few distant minute callose teeth, minutely revolute; apex narrowly acuminate; base cuneate or attenuate. Flowers solitary in the axils of the upper leaves; pedicels 60–130 mm long, ca. 1 mm diam., straight or slightly incurved, glabrous, bibracteolate in the lower half; bracteoles 0.5–3 mm long, linear. Hypanthium depressed hemispheric, 4–

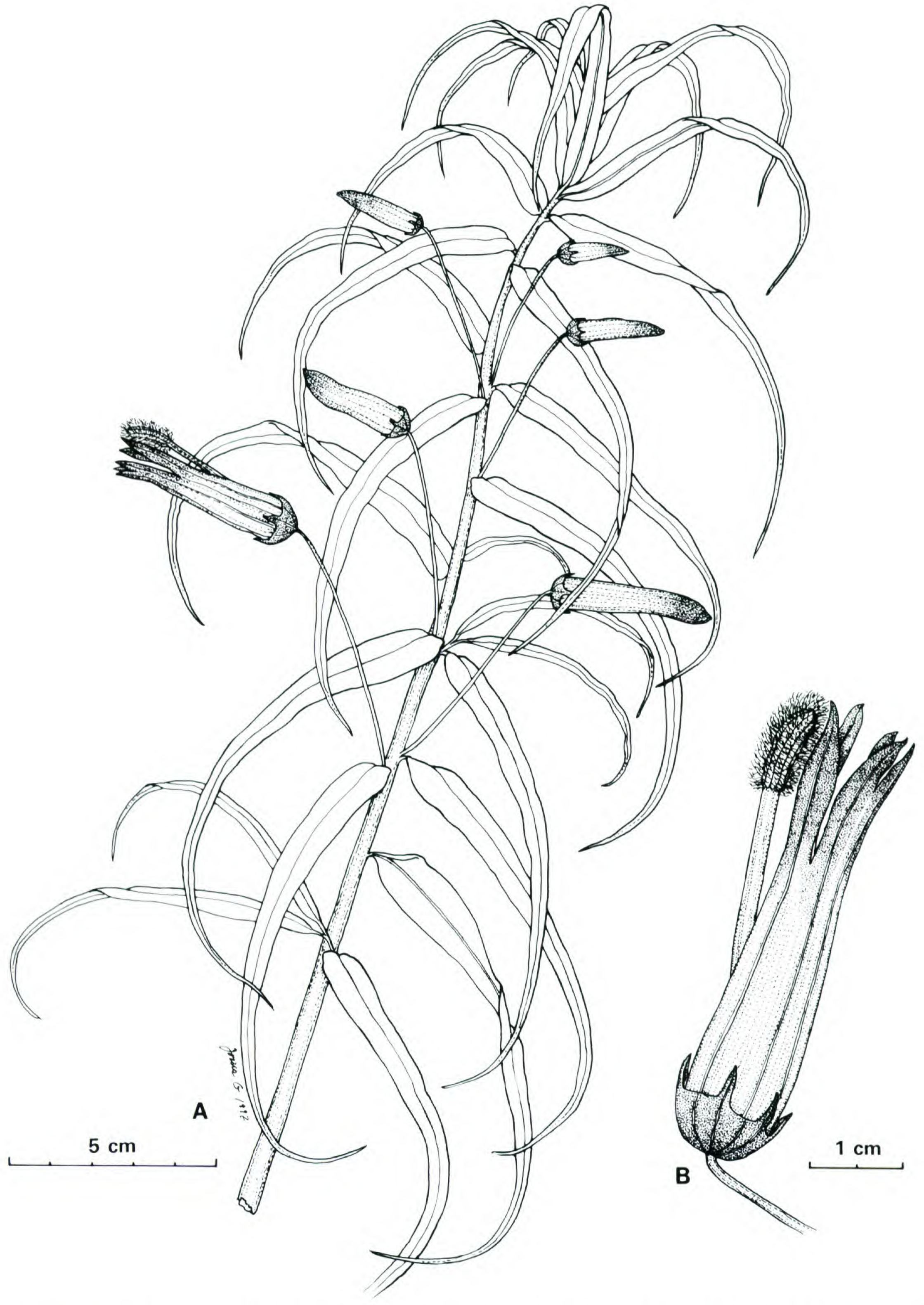

Figure 1. *Lobelia guerrerensis* Eakes & Lammers (from the holotype and *Reveal et al. 4337*, TEX). —A. Upper portion of stem. —B. Flower.

5 mm long, 9–11 mm diam., glabrous; base rounded or truncate. Calyx lobes narrowly triangular or triangular, 2.5–5 mm long, 1–2 mm wide, glabrous; margin entire; apex acuminate. Corolla yellow or yellowish orange on tube, grading to orange or red on the lobes, 35–44 mm long, glabrous; tube 19–25 mm long, 7–10 mm diam. at base, gradually tapering to 6–8 mm at mouth, laterally fenestrate, dorsally cleft nearly to base; dorsal lobes linear, 14–22 mm long, 1.5–3 mm wide, recurved, the apex acute; ventral lobes 12–21 mm long, straight or slightly deflexed, connate for most of their length, forming a trifid lip, these segments triangular, 4–8 mm long, 1.5–2.5 mm wide, acute at apex. Staminal column somewhat exserted; filament tube 29–33 mm long, 1.3–1.7 mm diam., pale yellow, glabrous; anther tube 2.5–4 mm diam., the surface from apex to base densely villous with dirty yellow trichomes 2–4 mm long; dorsal anthers 8.5–9 mm long; ventral anthers 7–7.6 mm long, with tufts of dirty yellow trichomes 1.5–2 mm long at apex. Capsule broadly ovoid, 8–10 mm long, 9–11 mm diam. Seeds honey-colored, ellipsoid or cylindrical, 0.7–0.8 mm long, 0.3–0.4 mm wide, 0.1–0.2 mm thick, the surface faintly striate.

Distribution, habitat, and phenology. Endemic to Guerrero, Mexico, where the plants grow on steep wooded slopes and moist embankments in pine, pine-oak, and mixed deciduous forests of the Sierra Madre del Sur, at elevations of 1890–2750 m. Flowering begins in early October and continues through February.

Etymology. This species takes its name from the state of Guerrero.

Relationships. As noted above, specimens of *L. guerrerensis* were identified previously as the narrow-leaved phase of *L. laxiflora* (see below). The two taxa are similar in habit, general size and shape of their leaves, inflorescence structure, floral structure, and seed morphology. However, the new species differs in its cernuous (vs. flat) leaves with the margin minutely revolute (vs. flat) and entire or subentire (vs. denticulate, serrulate, serrate, or doubly serrate); longer, denser, dirty yellow (vs. white) pubescence on the anther tube; broader capsules; and slightly larger seeds. Perhaps most conspicuously, the pigmentation pattern of the corolla is the reverse of that seen in *L. laxiflora*. In that species, the tube is orange or red and the lobes yellow or yellowish orange, while *L. guerrerensis* has just the opposite: yellow or yellowish orange tube with orange or red lobes.

Paratypes. MEXICO. **Guerrero**: Mazatlán, *Berlín 53* (ENCB); 1–3 km NW of Puerto El Gallo, *Breedlove 36058* (CAS, MICH); 37.9 km NE de El Paraíso, *Cowan 4961* (TEX); 6.5 km W de Puerto del Gallo por camino a Paraíso, *Hernández & Tenorio 858* (MICH); second ridge W of Petlacala, *Mexia 9049* (ARIZ, B, CAS, G, K, MO, NY, W); 3 mi. SW of Puerto del Gallo, *Reveal et al. 4337* (CAS, GH, K, MICH, MO, NY, TEX); Cerro Alquitrán cerca Tuxpan, *Schwabe in 1977* (B).

KEY TO THE SPECIES OF *LOBELIA* SECT. *HOMOCHILUS*

1a. Leaves broadly and conspicuously decurrent on stem, their margins coarsely dentate or lobed; pedicels shorter than the flowers; calyx lobe margins fimbriate-dentate; corollas monochromatic, purple or red-purple (Peru) . . . . . *L. decurrens* Cavanilles

1b. Leaves not decurrent on stem, their margins subentire or minutely toothed; pedicels equaling or longer than the flowers; calyx lobe margins entire or minutely toothed; corollas usually bicolored, yellow, orange, or red.

2a. Lamina broadest at or near middle, 3.5–8 cm wide, on stout petioles 10–30 mm long; stems, flowers, and ventral surface of lamina white-tomentose (Oaxaca) . . . . . *L. ghiesbreghtii* Decaisne

2b. Lamina usually broadest below middle, 0.2–5 cm wide, sessile or on slender petioles up to 7 mm long; stems, flowers, and ventral surface of lamina glabrous or pubescent, but never white-tomentose.

3a. Pedicels 85–210 mm long; calyx lobes 6–18 mm long; dorsal corolla lobes 20–33 mm long, the ventral 18–26 mm long; dorsal anthers 9–12 mm long, the ventral 7.5–9.5 mm long; capsules 10–15 mm long; seeds finely reticulate (Guerrero to Guatemala) . . . . . *L. aguana* F. E. Wimmer

3b. Pedicels 20–130 mm long; calyx lobes 1–6 mm long; dorsal corolla lobes 10–22 mm long, the ventral 10–21 mm long; dorsal anthers 6–9 mm long, the ventral 4.5–7.6 mm long; capsule 6–12 mm long; seeds faintly striate.

4a. Lamina cernuous, the margin entire or nearly so and minutely revolute; corolla yellow or yellowish orange on tube, red or orange on lobes; anther tube with dense dirty yellow trichomes 2–4 mm long from apex to base; ventral anthers with a tuft of dirty yellow trichomes 1.5–2 mm long at apex; capsules 9–11 mm diam.; seeds 0.7–0.8 mm long, 0.3–0.4 mm wide (Guerrero) . . . . . *L. guerrerensis* Eakes & Lammers

4b. Lamina plane, the margin denticulate, serrulate, serrate, or doubly serrate and flat; corolla red or orange on tube, orange or yellow on lobes; anther tube with sparse to moderately dense white trichomes 0.5–1 mm long on dorsal surface toward apex; ventral anthers with a tuft of white trichomes 0.7–1.3 mm long at apex; capsules 7–9 mm diam.; seeds 0.5–0.6 mm long, 0.2–0.3 mm wide (Arizona to Colombia) . . . . . *L. laxiflora* Kunth

Lobelia laxiflora, the species most similar to *L. guerrerensis*, is a geographically widespread and highly polymorphic species in which several varieties and forms have been recognized. The most commonly followed infraspecific classification is that of McVaugh (1943), who divided *L. laxiflora* into four varieties: var. *angustifolia* A. DC., var. *laxiflora*, var. *nelsonii* (Fernald) McVaugh, and var. *stricta* (Planchon & Oersted) McVaugh. However, Eakes's morphometric studies failed to support this classification. Instead, his analyses suggested that *L. laxiflora* could only be divided meaningfully into two sets of populations. The one set corresponded to variety *angustifolia*, while the other comprised specimens referable to the three other varieties. The two groups were largely parapatric and connected by occasional morphological intermediates in the contact zone.

Situations such as this are best expressed nomenclaturally by use of subspecific rank (cf. Lammers, 1988, 1990, 1995). Thus, *L. laxiflora* is here divided into subspecies *angustifolia* and autonymic subspecies *laxiflora*. The requisite change is effected below, followed by a key for their identification. Complete synonymy is given for subspecies *angustifolia*; all other names included under *L. laxiflora* by McVaugh (1943) are synonyms of the autonymic subspecies.

An added benefit of the use of subspecific rank in this case is that workers who find it useful to do so may continue to recognize McVaugh's (1943) three other varieties. Though Eakes's analyses did not support such a classification, subspecies *laxiflora* could be subdivided into variety *laxiflora*, variety *nelsonii*, and variety *stricta* by those who believe that these taxa can be distinguished in their region.

Lobelia laxiflora subsp. **angustifolia** (A. DC.) Eakes & Lammers, stat. nov. Basionym: *Lobelia laxiflora* var. *angustifolia* A. DC., in DC., Prodr. 7: 383. 1839. *Lobelia persicifolia* var. *angustifolia* (A. DC.) Vatke, Linnaea 38: 723. 1874. *Lobelia laxiflora* f. *angustifolia* (A. DC.) Voss, in Siebert & Voss, Vilm. Blumengärtn. (ed. 3) 1: 576. 1894. *Lobelia angustifolia* (A. DC.) Urbina, Cat. Pl. Mexican. 201. 1897; non Chamisso, Linnaea 8: 219. 1833; nec Bentham, in Endlicher, Enum. Pl. 74. 1837. TYPE: Mexico. México: Toluca, Apr. 1834, *Andrieux 267* (lectotype, here designated, K; photograph, F; isolectotypes, K, W). De Candolle based the name on this collection plus three icones, two published descriptions, and living plants seen in cultivation. Of these, the specimen can best be identified with the description. However, the collection is not represented in De Candolle's own herbarium, and a duplicate is designated as the lectotype.

Lobelia dracunculoides Willdenow ex Schultes, in Roemer & Schultes, Syst. Veg. 5: 56. 1819. TYPE: "America meridionalis," leg. Humboldt & Bonpland, *Herb. Willdenow 3989* (holotype, B-W [IDC-microfiche!]).

Rapuntium kunthianum C. Presl, Prodr. Monogr. Lobel. 27. 1836. *Lobelia persicifolia* var. *amygdalina* Vatke, Linnea 38: 723. 1874. Both validated by indirect reference to: *Lobelia persicifolia* Cavanilles sensu Kunth, in HBK, Nov. Gen. Sp. 3: 310 (quarto), 242 (folio). 1819; non Cavanilles, Icon. 6: 12. 1801; nec Lamarck, Encycl. 3: 584. 1792. TYPE: Mexico. México: prope Zumpango, *Humboldt & Bonpland s.n.* (lectotype, here selected, P-Bonpl. [IDC-microfiche!]; isolectotypes, B, B-W [IDC-microfiche!]). Though there is no evidence that Presl saw any of these sheets, Article 7.7 of the *Code* (Greuter et al., 1994) dictates that in cases such as this, the type be designated in the context of the validating description. This is not an avowed substitute for illegitimate *L. persicifolia* Cavanilles; on the same page, Presl recognized that species under the replacement name *Rapuntium cavanillesianum* (Schultes) C. Presl.

Lobelia cavanillesii var. *lutea* F. Haage & K. Schmidt, Gartenflora 52: 577. 1903. *Lobelia laxiflora* f. *lutea* (F. Haage & K. Schmidt) F. E. Wimmer, Pflanzenr. IV.276b: 682. 1953. TYPE: not located. Name based on yellow-flowered plants raised from normally pigmented progenitors at a commercial nursery in Erfurt, Germany.

Lobelia nelsonii var. *fragilis* B. L. Robinson & Fernald, Proc. Amer. Acad. Arts 43: 27. 1907. *Lobelia laxiflora* f. *fragilis* (B. L. Robinson & Fernald) F. E. Wimmer, Pflanzenr. IV.276b: 682. 1953. TYPE: Mexico. Morelos: Parque Station, rocky hills, 7500 ft., 13 Feb. 1907, *Pringle 10360* (holotype, GH; photograph, F; isotypes, B, BM, E, F, G[3], GOET, K, MEXU, MIN, MO, NY, PH, US, W).

Lobelia laxiflora var. *brevipes* F. E. Wimmer, Pflanzenr. IV.276b: 683. 1953. TYPE: Mexico. Baja California: Cape region, Jan.–Mar. 1901, *Purpus 234* (holotype, WU; isotypes, E, K, MO, US).

KEY TO THE SUBSPECIES OF *LOBELIA LAXIFLORA*

1a. Lamina 1–5 cm wide, 2–8 times longer than wide, the base rounded, obtuse, or cuneate . . . . . *L. laxiflora* subsp. *laxiflora*

1b. Lamina 0.2–1.4 cm wide, 12–18 times longer than wide, the base attenuate . . . . . *L. laxiflora* subsp. *angustifolia*

ERRORS IN PRIORITY

While preparing the checklist of world Campanulaceae, I discovered three species that were known by illegitimate names, because an epithet with priority had been overlooked. Although Article 14.1 permits conservation of names threatened in this fashion, I do not consider such action appropriate in these cases, as the changes proposed here will likely prove "disadvantageous" to few if any workers. As was the case with *Campanula immodesta* Lammers and *Wahlenbergia brehmeri* Lammers (Lammers, 1998a), these three species belong

to large genera and are not particularly well known. Few botanists would recognize them off-hand or be able to distinguish them from congeners without recourse to keys and comparative material. As such, they scarcely constitute "useful exceptions," and I judge it best to allow the rules of priority to operate unhindered.

The *Flora of Turkey* includes a species of perennial *Campanula* known in the literature (e.g., Damboldt, 1978; Greuter et al., 1984; Heller & Heyn, 1993) as *C. latiloba* A. DC. From its description, *C. grandis* Fischer & C. A. Meyer clearly refers to the same species and has long been treated as its synonym (Boissier, 1875; Beddome, 1907; Bailey & Lawrence, 1953; Lewis & Lynch, 1989). The two names were both published during 1839. However, De Candolle's binomial was published in volume 7, part 2, of his father's *Prodromus*, which appeared in late December, while Fischer and Meyer's appeared in the fifth annual *Index Seminum* of the botanical garden at St. Petersburg, issued the previous January (Stafleu & Cowan, 1976). Thus, as pointed out by Crook (1951), *Campanula grandis* had more than 10 months' priority over *C. latiloba* and is the legitimate name of the species. A new combination is effected here so that a recently described subspecies has a name under the legitimate species name:

Campanula grandis subsp. **rizeensis** (A. Güner) Lammers, comb. nov. Basionym: *Campanula latiloba* subsp. *rizeensis* A. Güner, Candollea 39: 348. 1984. TYPE: Turkey. Rize: Çamlıhemşin çevresi, sarp kayalık, ca. 250 m, 21 May 1981, *A. Güner 3547* (holotype, HUB not seen; isotype, ANK not seen).

In the Cordillera Central of Colombia is a robust species of *Centropogon* that was called *C. willdenowianus* (C. Presl) F. E. Wimmer by Wimmer (1943) and McVaugh (1949). However, the basionym of that name was an avowed substitute for a legitimate name, and a later homonym besides. Therefore, it must be replaced.

This species was first described under the name *Lobelia ayavacensis* Schultes in the fifth volume of the *Systema Vegetabilium*, issued in December 1819. The description was based on a sheet in the Willdenow herbarium at B, which was given the serial number 4003. This sheet bears no information on locality or collector, only the binomial and the initial "W." for Willdenow. In the protologue, however, Schultes indicated it was collected in tropical America by Humboldt and Bonpland. This sheet is a mixed collection. In the center is a fertile stem apex belonging to the Colombian species. Flanking it are a detached leaf (left) and flower (right) belonging to a superficially similar but entirely different species, *Siphocampylus umbellatus* (Kunth) G. Don (based on *Lobelia umbellata* Kunth), endemic to the states of Minas Gerais and Rio de Janeiro in Brazil.

The source of this extraneous material is apparently the type of *L. umbellata* (*Humboldt & Bonpland s.n.*, P-Bonpl. [IDC-microfiche!]). That sheet is likewise a mixed collection, bearing not only a fertile stem apex of Brazilian *S. umbellatus*, but also a detached flower and leaf of the Colombian species. Thus it appears that portions of two discrete specimens were inadvertently interchanged. Perhaps this occurred when Humboldt took his collection to Berlin to sort and arrange it with Willdenow (cf. McVaugh, 1955). Whatever its origin, this mixing of material resulted in taxonomic confusion. Kunth (1820, 1823) treated *L. ayavacensis* as a synonym of *L. umbellata* (which had a month's priority), as did Don (1834), who transferred the species to *Siphocampylus* Pohl.

Presl (1836) was the first to become aware of the mix-up and attempt to remedy it. He recognized *L. umbellata* and immediately following it, a second species, *L. willdenowiana* C. Presl. This name was not accompanied by a description or diagnosis, merely the parenthetical notation "L. ayavacensis *Willd. herb. n.* 4003, *specim. medium.*"

In light of modern practice, Presl accomplished three things with this brief citation. First, as defined by Article 32.5 of the *Code*, he provided an indirect reference to a validly published diagnosis, that of *L. ayavacensis*. Second, he designated the portion of the original material of that name that best matched the diagnosis to be the lectotype. Third, he proposed the name *L. willdenowiana* as an avowed substitute (nomen novum) for *L. ayavacensis*. It was this last move that caused problems. Though it was common in the nineteenth century to simply abandon names based on mixed collections, the *Code* now requires (Art. 9.10) that such a name remain attached to that part of the type that corresponds most nearly with the original diagnosis. Because the portion explicitly cited by Presl better matches the diagnosis of *L. ayavacensis*, he should have retained that name. Furthermore, the new name he proposed violates Article 53.1, as it is a later homonym of *L. willdenowiana* Schultes, a synonym of *Lysipomia aretioides* Kunth (Wimmer, 1953). For these reasons, new combinations are necessary for both the species proper and for the heteronymic subspecies recognized by McVaugh (1949):

Centropogon ayavacensis (Willdenow ex Schultes) Lammers, comb. nov. Basionym: *Lobelia ayavacensis* Willdenow ex Schultes, in Roemer & Schultes, Syst. Veg. 5: 57. 1819. *Lobelia willdenowiana* C. Presl, Prodr. Monogr. Lobel. 39. 1836, nom. superfl.; non Schultes, in Roemer & Schultes, Syst. Veg. 5: 634. 1819. *Siphocampylus umbellatus* var. *willdenowianus* (C. Presl) A. DC., in DC., Prodr. 7: 406. 1839. *Centropogon willdenowianus* (C. Presl) F. E. Wimmer, Repert. Spec. Nov. Regni Veg. 22: 204. 1926. TYPE: "In America merid.," leg. Humboldt & Bonpland, *Herb. Willdenow 4003* (lectotype, selected by Presl [1836: 39], stem portion in middle, B-W [IDC-microfiche!]).

Siphocampylus stellatus Gleason, Bull. Torrey Bot. Club 52: 67. 1925. TYPE: Colombia. Tolima: between Volcancito and Roble, 27 Jan. 1853, *Holton s.n.* (holotype, NY).

Centropogon ayavacensis subsp. **cylindricus** (Gleason) Lammers, comb. nov. Basionym: *Siphocampylus cylindricus* Gleason, Bull. Torrey Bot. Club 52: 66. 1925. *Centropogon cylindricus* (Gleason) F. E. Wimmer, Pflanzenr. IV.276b: 257 (1943). *Centropogon willdenowianus* subsp. *cylindricus* (Gleason) McVaugh, Brittonia 6: 480. 1949. TYPE: Colombia. Tolima: Rosalito to Murillo, *Pennell 3142* (holotype, NY).

In southern and central Africa is a small short-lived species of *Lobelia* that was called *L. depressa* L. f. by Wimmer (1953). However, the type of that name (*Linné filius HU77*, S-LINN not seen) is not referable to the genus *Lobelia* but rather to *Monopsis* Salisbury. Thulin (1983, 1984) identified the specimen as *M. simplex* (L.) F. E. Wimmer, while Phillipson (1986) treated it as *M. debilis* (L. f.) C. Presl var. *depressa* (L. f.) Phillipson.

The earliest name actually referable to this *Lobelia* was *Mezleria depressa* A. DC. However, that name was illegitimate, as it was a later homonym of *M. depressa* (L. f.) C. Presl. Though De Candolle had cited Presl as the authority for the binomial, he specifically excluded its basionym, *L. depressa*, making it a new name based on its own type (Art. 48.1). The earliest legitimate name referable to this *Lobelia* is *Mezleria dregeana* Sonder, which had been proposed as an explicit replacement for illegitimate *M. depressa*. However, use of its epithet in *Lobelia* is precluded by the existence of *L. dregeana* (C. Presl) A. DC. Finally, *L. sonderi* Zahlbruckner was published so that *M. dregeana* would have a name in the genus *Lobelia*.

Thulin (1983, 1984) enlarged the circumscription of this species considerably. Among the many new synonyms were several that had priority over *L. sonderi*, the earliest among them *L. angolensis* and *L. lythroides*. Thulin took up the former for the enlarged species.

In doing so, he (like Zahlbruckner before him) unfortunately overlooked an earlier legitimate epithet. When Kuntze took up the generic name *Dortmanna* Hill for the species then assigned to *Lobelia*, he published *D. sonderiana* Kuntze as an avowed substitute for *M. dregeana*. This replacement name was necessitated by his simultaneous validation of *D. dregeana* (C. Presl) Kuntze for *L. dregeana*. Thus, *sonderiana* is the earliest epithet referable to this species, and the new combination required by the *Code* is effected here:

Lobelia sonderiana (Kuntze) Lammers, comb. nov. Basionym: *Dortmanna sonderiana* Kuntze, Revis. Gen. Pl. 2: 972. 1891. Replaced name: *Mezleria dregeana* Sonder, in Harvey & Sonder, Fl. Cap. 3: 533. 1865; non *Dortmanna dregeana* (C. Presl) Kuntze, Revis. Gen. Pl. 2: 972. 1891; nec *Lobelia dregeana* (C. Presl) A. DC., in DC., Prodr. 7: 731. 1839. Replaced name: *Mezleria depressa* A. DC., in DC., Prodr. 7: 350. 1839; non *Mezleria depressa* (L. f.) C. Presl, Prodr. Monogr. Lobel. 7. 1836; nec *Lobelia depressa* L. f., Suppl. Pl. 395. 1782. *Lobelia sonderi* Zahlbruckner, Ann. K. K. Naturhist. Hofmus. 18: 404. 1903, nom. superfl. *Lobelia depressa* var. *dregeana* (Sonder) F. E. Wimmer, Notizbl. Bot. Gart. Berlin-Dahlem 15: 633. 1941. TYPE: South Africa. Cape Province: Witbergen, *Drège s.n.* (holotype, G-DC [IDC-microfiche!]).

Lobelia lythroides Diels, Bot. Jahrb. Syst. 26: 113. 1899. TYPE: South Africa. Transvaal: Pretoria, *Wilms 883* (syntype, B not seen) and *Wilms 886* (syntype, B not seen).

Lobelia angolensis Engler & Diels, Bot. Jahrb. Syst. 26: 114. 1899. TYPE: Angola. Huila, *Welwitsch 1146* (syntype, B not seen) and *Antunes 94* (syntype, B not seen).

[Additional heterotypic synonyms cited by Thulin (1983, 1984).]

As an aside, it should be noted that *L. depressa* is the type of *Mezleria* C. Presl (Pfeiffer, 1874: 298). This generic name typically has been used for a subgenus of *Lobelia* (e.g., Wimmer, 1953; Murata, 1995), but can no longer serve that purpose because, as noted above, the type of *L. depressa* is referable to the genus *Monopsis*. As a result, *Mezleria* is a synonym of *Monopsis* and cannot be used

for any taxon in *Lobelia*. When circumscribed following Wimmer (1953), the subgenus has no name available; under the broader circumscription of Murata (1995), it may be called *Lobelia* subg. *Isolobus* (A. DC.) Y. S. Lian.

New Assignments

Continued work on the checklist disclosed several more species (or subspecies) that do not have a legitimate name in the genus (or species) to which they should be assigned.

Recent studies in my lab (cf. Morris & Lammers, 1997a, 1997b) have supported Grey-Wilson's (1990) suggestion that *Leptocodon* (Hooker f.) Lemaire be subsumed into *Codonopsis*. Unpublished cladistic analyses of morphological and palynological data by Morris indicate that the two species that comprise *Leptocodon* are embedded well within the structure of *Codonopsis*. The type of *Leptocodon* already has a name available in *Codonopsis*. Here, a new combination is proposed for the other species, to complete the merger of the two genera:

Codonopsis hirsuta (D. Y. Hong) K. E. Morris & Lammers, comb. nov. Basionym: *Leptocodon hirsutus* D. Y. Hong, Acta Phytotax. Sin. 18: 246. 1980. TYPE: China. Xizang: Zayu, Shang Zayu Zhong Xiang A Zha, mixed forest on slope, 2500 m, *Qinghai-Xizang Exped. Team 73-1014* (holotype, PE not seen).

These same studies also support the recognition of *Campanumoea* Blume sect. *Cyclocodon* (Griffith) C. B. Clarke as a distinct genus, a conclusion reached independently by Hong (1998). In order to preserve the subspecific classification proposed by Moeliono (1960), a new combination under *Cyclocodon* is required:

Cyclocodon lancifolius subsp. **celebicus** (Blume) K. E. Morris & Lammers, comb. nov. Basionym: *Campanumoea celebica* Blume, Bijdr. 727. 1825. *Campanula celebica* (Blume) D. Dietrich, Syn. Pl. 1: 758. 1839. *Codonopsis celebica* (Blume) Miquel, Fl. Ned. Ind. 2: 566. 1857. *Codonopsis lancifolia* subsp. *celebica* (Blume) Moeliono, in Steenis, Fl. Males. (ser. 1) 6(1): 121. 1960. *Cyclocodon celebicus* (Blume) D. Y. Hong, Acta Phytotax. Sin. 36: 109. 1998. TYPE: Indonesia. Sulawesi: sine loc., *Reinwardt s.n.* (holotype, L not seen).

Codonopsis leucocarpa Miquel, Fl. Ned. Ind. 2: 565. 1857. TYPE: Indonesia. Sumatra: in de kloof van den Singalang, *Teijsmann s.n.* (holotype, U not seen).

As noted previously (Lammers, 1998a), my treatment of the Hawaiian Lobelioideae (Lammers, 1990) for the *Manual of the Flowering Plants of Hawai'i* occasionally synonymized taxa that subsequent studies suggest should be recognized at some level. Case in point: *Cyanea baldwinii* C. N. Forbes & G. C. Munro from Lāna'i. Impressed by the overall similarity of its leaves and flowers to those of *C. lobata* H. Mann from northern West Maui, I treated the former as a mere synonym of the latter. More detailed study, however, revealed characters by which the two could be distinguished, and it is consistent with my practice elsewhere to treat them as allopatric subspecies:

Cyanea lobata subsp. **baldwinii** (C. N. Forbes & G. C. Munro) Lammers, comb. et stat. nov. Basionym: *Cyanea baldwinii* C. N. Forbes & G. C. Munro, Occas. Pap. Bernice Pauahi Bishop Mus. 7: 43. 1920. *Delissea baldwinii* (C. N. Forbes & G. C. Munro) H. St. John, Phytologia 63: 81. 1987. TYPE: Hawaiian Islands. Lāna'i: Lāna'ihale, but one tree seen, near top of ridge close to trail, just before ascending the strip part of trail, growing amongst thick scrub, 3000 ft., Sep. 1919, *Munro 674* (holotype, BISH; isotypes, BISH[2], NSW, NY, UC).

Key to the Subspecies of *Cyanea lobata*

1a. Petiole 1/6–1/4 as long as the lamina; calyx lobes 10–15 mm long, 2.4–4 mm wide, narrowly oblong or narrowly triangular; dorsal anthers 12–13.5 mm long . . . . . *C. lobata* subsp. *baldwinii*

1b. Petiole 1/3–1/2 as long as the lamina; calyx lobes 16–22 mm long, 3–7.5 mm wide, elliptic or oblong; dorsal anthers 9–11.5 mm long . . . . . *C. lobata* subsp. *lobata*

Previously (Lammers, 1988, 1990), I treated all populations of *Delissea* with a palm-like habit as a single species, *D. undulata* Gaudichaud, divided into three allopatric subspecies: subsp. *niihauensis* (H. St. John) Lammers from the westernmost island, Ni'ihau; subsp. *kauaiensis* Lammers from nearby Kaua'i; and subsp. *undulata* from the easternmost islands of West Maui and Hawaii. This classification was not consistent with my treatment of similar complexes among the Hawaiian Lobelioideae, as the morphological gap separating the two western subspecies from the eastern subspecies was quite wide when compared to that which usually separates conspecific subspecies. Furthermore, in no other instance have I recognized conspecific subspecies that are separated geographically by several islands. For these reasons, I now recognize two spe-

cies of palmiform *Delissea: D. undulata* on Hawai'i, and *D. niihauensis* H. St. John with allopatric subspecies on Ni'ihau and Kaua'i. A new combination is needed for the last:

Delissea niihauensis subsp. **kauaiensis** (Lammers) Lammers, comb. nov. Basionym: *Delissea undulata* subsp. *kauaiensis* Lammers, Syst. Bot. 13: 505. 1988. TYPE: Hawaiian Islands. Kaua'i: on the Hanapēpē and Wahiawā watershed, 24 June 1895, *Heller 2430* (holotype, MSC; isotypes, A, AC, BM, E, F[2], G, GH, K, MIN, NY, P, UC, US).

KEY TO PALMIFORM *DELISSEA*

1a. Lamina elliptic or lanceolate, 3–4 times longer than wide, the base cuneate, the margin undulate and denticulate; peduncles 15–50 mm long (Hawai'i) . . . . . *D. undulata*
1b. Lamina ovate, 1.3–2 times longer than wide, the base cordate or truncate, rarely cuneate, the margin flat and crenate or serrate; peduncles 5–20 mm long . . . . . *D. niihauensis*
2a. Lamina 5–11 cm long, 3.5–7 cm wide, base cordate, apex acute, margin callose-crenate (Ni'ihau) . . . *D. niihauensis* subsp. *niihauensis*
2b. Lamina (7–)14–18 cm long, (3–)7–10 cm wide, base truncate or rarely cuneate, apex acuminate, margin coarsely callose-serrate (Kaua'i) . . . . . *D. niihauensis* subsp. *kauaiensis*

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Seven New Species of *Pilea* Lindley (Urticaceae) from Mesoamerica

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ABSTRACT. Seven new species of *Pilea* from Mesoamerica are described and illustrated: *Pilea pteridophylla* A. K. Monro, *P. plumulosa* A. K. Monro, *P. tripartita* A. K. Monro, *P. rostulata* A. K. Monro, *P. quadrata* A. K. Monro, *P. tutensis* A. K. Monro, and *P. magnicarpa* A. K. Monro. Their affinities are discussed and positions within Weddell's and Killip's subdivisions of the genus indicated.

Pilea is a genus mainly composed of small shade-loving herbs and is distributed throughout the tropics, subtropics, and temperate regions (with the exception of Australia, New Zealand, and Europe), with the greatest diversity in the Greater Antilles. *Pilea* can be distinguished from other Mesoamerican Urticaceae by opposite leaves and a single ligulate intrapetiolar stipule in each axil. Cystoliths, found on the stem, leaves, and frequently inflorescence, vary greatly within and between species, but are distinctive in frequently appearing branched, forming "V," "Y," and "X" shapes.

The last major worldwide taxonomic treatment of the genus *Pilea* was H. A. Weddell's treatment of 1869, in which 159 species were recognized (24 of which were described as new). Since then, over 500 new species names have been published, and it is likely that there are over 500 to 600 "good" species worldwide (Adams, 1970; Burger, 1977). Major contributions to the taxonomy of neotropical *Pilea* have been made by E. P. Killip in his revision of the Andean species (Killip, 1936, 1939), P. C. Standley and J. A. Steyermark (1952) in their treatment for the *Flora of Guatemala*, C. D. Adams (1972) in his treatment for the *Flowering Plants of Jamiaca*, and W. C. Burger (1977) in his treatment for *Flora Costaricensis*. Weddell (1869) subdivided the genus, on the basis of leaf morphology, into three principal species groups: *Integrifoliae*, with leaves of equal length at each node and entire margins; *Heterophyllae*, with leaves of unequal length at each node; and *Dentatae*, with leaves of equal length at each node and toothed margins. Killip (1936) subdivided *Pilea* into 12 species groups, based largely on those of Weddell's conspecti of 1856 and 1869. In the absence of recent phylogenetic analysis, the new species described here are best placed in three of the subgeneric groups cited in this article: *Fallaces*, *Molles*, and *Centradenoideae*. These three subgeneric groups can be recognized on the following suites of characters: subgenus *Fallaces* with toothed pinnately nerved leaves, where no pair of the secondary nerves are more prominent than the others; subgenus *Molles* with pubescent, toothed, 3-nerved or pinnately nerved leaves (where pinnately nerved a basal pair of secondary veins is markedly more prominent than the others), of equal size at each node, averaging more than 2 cm in length and compact staminate inflorescences where the peduncles are longer than the panicle branches; subgenus *Centradenoideae* with 3-nerved or pinnately nerved leaves (where pinnately nerved a basal pair of secondary veins is much more prominent than the others), of unequal size at each node, the smaller leaf at each node symmetrical, with stipules less than 3 cm long and pedunculate pistillate inflorescences.

In preparing revisionary accounts of *Pilea* for *Flora Mesoamericana*, over 1700 collections from Central and South America were examined. During the course of this work, the following seven new species were identified.

Pilea pteridophylla A. K. Monro, sp. nov. TYPE: Mexico. Tabasco: Sierra el Madrigal, Teapa, Tabasco, a 600 m al E del edificio principal del Centro Regional Tropical Puyacatengo de la Universidad Autónoma de Chapingo, 5 June 1991, *A. M. Hanan A. 438* (holotype, MEXU). Figure 1A, B.

Species foliis pectinatis a congeneribus diversa.

Herb to 35 cm, perennial; epipetric, monoecious. *Stems* erect, sparsely branched, rooting at the base; internodes 2–8 × 1.5–2.5 mm, weakly striate, drying dark green, glabrous, cystoliths not visible. *Blades of leaves* at the same node of equal length, petiolate, 45–90 × 7–12 mm, linear-lanceolate,

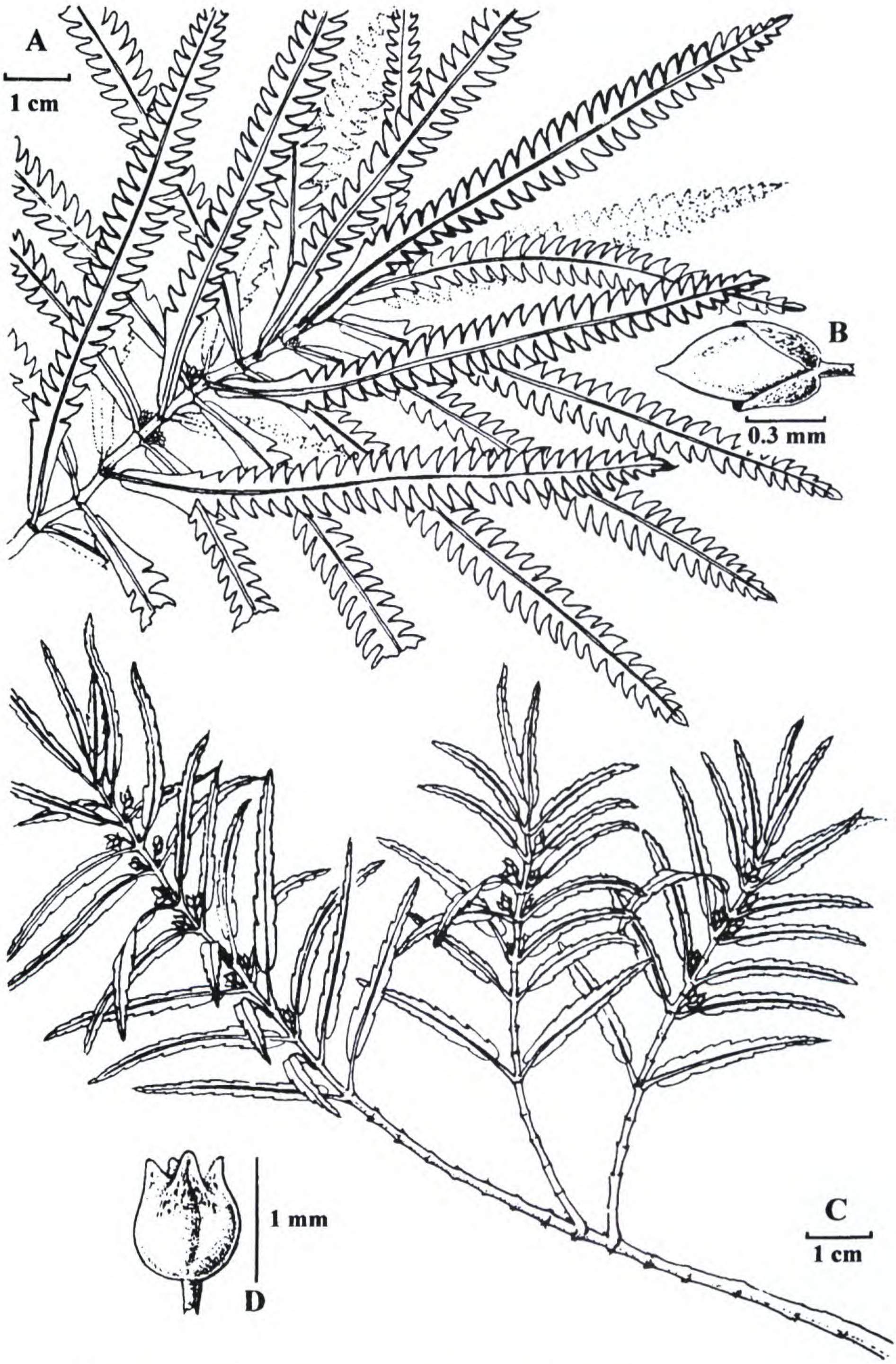

Figure 1. A, B. *Pilea pteridophylla* A. K. Monro. —A. Habit, plant with pistillate inflorescences. —B. Fruit. C, D. *Pilea plumulosa* A. K. Monro. —C. Habit, plant with infructescences. —D. Staminate flower prior to anthesis. A and B based on *Hanan 438*. C and D based on *Kirkbride & Duke 944*.

pectinate above the basal ⅛ to ⅙, chartaceous; adaxial surface drying dark green, glabrous, cystoliths fusiform, V-, Y-, and X-shaped; abaxial surface drying dark gray-green, glabrous, cystoliths fusiform, V-, Y-, and X-shaped, punctate glandular; base asymmetrical, decurrent, attenuate, rounded; apex symmetrical, weakly cuspidate; primary venation pinnate, secondary veins 19–28 pairs, 75–

90° to the midrib; petioles equal, 0.8–1.3 × ca. 0.8 mm, glabrous; stipules 0.8–1.0 × 1.0–1.3 mm, deltate, membranous, gray, persistent. *Inflorescences* 7–24 per stem, unisexual, pistillate inflorescences preceding and concurrent with staminate inflorescences; peduncle and pedicels subtended by stipuliform bracts, peduncular bract 0.5–0.8 mm, deltate, pedicellular bracts ca. 0.4 mm, narrow deltate; intact staminate inflorescences not seen; flowers in bud immediately prior to anthesis 1.0–1.3 × 0.8–1.3 mm, cream, apically green; tepals 4, ca. 1.3 mm, ovate, glabrous; subapical appendages ca. 0.3 mm, ridge-like, glabrous; stamens 4, filaments ca. 1.3 mm, anthers ca. 0.4 × ca. 0.5 mm; pistillate inflorescences 1 or 2 per axil, 1.5–2.0 mm, bearing 5–35 flowers in a loose panicle, peduncle ¼ to ⅓ inflorescence length, ca. 0.4 mm diam., glabrous; pedicels ca. 0.3 × ca. 0.1 mm to inconspicuous, glabrous; flowers 0.5–0.7 × ca. 0.3 mm, glabrous; tepals 3, unequal, the central one ca. 0.5 mm, oblong with a dorsal thickening, the two lateral ca. 0.5 mm, ovate, lacking a dorsal thickening. *Infructescences* ca. 2–3 mm, peduncle 0.5 mm diam.; fruit 0.7–0.8 × ca. 0.4 mm, asymmetrical, subcompressed ovoid, orange-brown, the margin broadening and flattened toward the apex.

Distribution. Known only from the type collection, growing in evergreen forest in Tabasco, southern Mexico.

Discussion. This species falls within Weddell's *Dentatae* and Killip's *Fallaces* species groups. It is unmistakable on account of its pectinate leaves. These resemble the fronds of a fern in color and texture as well as shape (Fig. 1A). It is the only species of *Pilea* with pectinate leaves known from the Americas.

Pilea plumulosa A. K. Monro, sp. nov. TYPE: Panama. Bocas del Toro-Chiriquí border: elfin forest at continental divide on Chiriquisito–Caldera trail, 20 Apr. 1968, *J. H. Kirkbride & J. A. Duke 944* (holotype, MO [sheet no. 2605434]; isotypes, MO [sheet no. 2090983], NY). Figure 1C, D.

Species *P. killipianae* Standley & Steyermark affinis, sed floribus staminalibus minimis, seminibus majoribus, differt.

Shrublet to 25 cm, perennial; epipetric, monoecious. *Stems* erect, branched, rooting at the base; internodes 3.0–10.5 × 1–2 mm, weakly striate, drying gray-brown, glabrous, cystoliths elliptic, becoming obscure with age. *Blades of leaves* at the same node of equal length, petiolate, 12–38 × 1.5–4.0 mm, linear-lanceolate, chartaceous; adaxial surface drying dark brown-green, glabrous, cystoliths fusiform; abaxial surface drying yellow-green, glabrous, cystoliths orbicular, punctate glandular; base asymmetrical, subcordate and cuneate, acute; margin crenate with basal ¼ to ⅓ entire; apex symmetrical, acute; primary venation pinnate, occasionally appearing 3-nerved, where appearing 3-nerved then lateral nerves much less prominent than the midrib, running ⅓ to ¼ the length of the leaf, secondary veins 4–13 pairs, 30–45° to the midrib; petioles unequal in pair by ratio 1:2.0–4.5, the longer 2.3–4.5 × 0.5–0.8 mm, the shorter 1.0–1.8 × 0.5 mm, glabrous; stipules 0.5–0.8 × 0.5 mm, ovate, membranous, brown, persistent. *Inflorescences* 6–28 per stem, unisexual, pistillate inflorescences preceding and concurrent with staminate inflorescences; peduncle and pedicels subtended by stipuliform bracts, peduncular bract ca. 0.5 mm, deltate, ovate, pedicellular bracts 0.4–0.8 mm, ovate; staminate inflorescences 1 or 2 per axil, 3.5–7.0 mm, bearing 6–10 flowers in a single compact head; peduncle ½ to ⅔ inflorescence length, ca. 0.3 mm diam., glabrous; pedicels 0.8–1.3 × ca. 0.1 mm, glabrous; flowers in bud immediately prior to anthesis 1.0–1.3 × 1.0–1.3 mm, cream; tepals 4, ca. 1.5 mm, ovate, elliptic, glabrous; subapical appendages ca. 0.3 mm, ridge-like, glabrous; stamens 4, filaments ca. 2 mm, anthers ca. 0.5 × ca. 0.5 mm; pistillate inflorescences 1 or 2 per axil, ca. 3 mm, bearing 5–8 flowers in a single compact head, peduncle ⅓ inflorescence length, ca. 0.1 mm diam., glabrous; pedicels 0.3–0.5 × ca. 0.1 mm, glabrous; flowers ca. 0.8 × ca. 0.5 mm, glabrous; tepals 3, unequal, the central one ca. 0.8 mm, oblong-obovate, with a dorsal thickening, the lateral two ca. 0.7 mm, ovate, without a dorsal thickening. *Infructescences* 3.0–4.5 mm, peduncle ca. 0.1 mm diam.; fruit ca. 1.5 × ca. 1.0 mm, asymmetrical, subcompressed elliptic, pale brown, the margin narrow, thickened.

Distribution. Known only from the type collection made in the western end of the Cordillera Central in Panama, where it was growing on rocky outcrops in elfin forest.

Discussion. This species falls within Weddell's *Dentatae* and Killip's *Fallaces* species groups. A sterile collection from Chiriquí, *Dwyer & Lallathin 8769* (MO), collected at 4500–5500 m, resembles *P. plumulosa*. *Pilea plumulosa* most closely resembles *P. killipiana* from Chiapas (Mexico) and Guatemala, differing as summarized below:

Pilea killipiana: sparsely branched or unbranched, the leaf-bearing part of the stem her-

baceous; staminate flowers in bud immediately prior to anthesis 1.8–2.0 mm; fruit ca. 0.8 mm.

Pilea plumulosa: extensively branched, the leaf-bearing part of the stem woody; staminate flowers in bud immediately prior to anthesis 1.0–1.3 mm; fruit ca. 1.5 mm.

From the available collections, the distributions of the two species do not appear to overlap: *P. killipiana* is known only from Chiapas in southern Mexico and the states of the Petén and Alta Verapaz in northern Guatemala, while *P. plumulosa* is known only from western Panama.

This species is named for the feather-like outline of the leaves.

Pilea tripartita A. K. Monro, sp. nov. TYPE: Costa Rica. San José-Cartago border: summit of the Interamerican Highway at 3200–3300 m altitude near La Asunción, 21 Nov. 1969, *W. C. Burger & R. L. Liesner 6330* (holotype, MO; isotypes, NY, US). Figure 2A, B.

Species *P. cornuto-cucullatae* Cufodontis similis, sed floribus staminalibus tripartitis, seminibus majoribus, differt.

Herb to 25 cm, perennial; terrestrial, epiphytic or epipetric; monoecious. *Stem* erect or repent, sparsely branched, rooting at base and adventitiously where repent; internodes 12–60 × 1.5–2.0 mm, weakly striate, drying green to pale brown, pubescent, the hairs to 0.8 mm, upright or weakly appressed, curved, cystoliths fusiform. *Blades of leaves* at the same node of equal length, petiolate, 12–40 × 10–20 mm, elliptic to ovate, chartaceous; adaxial surface drying dark green, glabrous to sparsely pubescent on the midrib, where pubescent the hairs to 0.8 mm, weakly appressed, curved, cystoliths fusiform; abaxial surface drying olive green, glabrous to pubescent on the primary and secondary veins, where pubescent the hairs to 0.8 mm, appressed, curved, cystoliths fusiform or minute pusticulate, eglandular; base asymmetrical, weakly decurrent to cuneate; margin serrate; apex acute; primary venation 3-nerved, the two lateral nerves stopping short of the leaf apex, secondary veins 4–6 pairs, 30–45° to the midrib; petioles equal or unequal in pair by ratio of 1:1.5–3.0, 10–40 × 0.5 mm, pubescent, the hairs to 0.8 mm, weakly appressed, weakly curved; stipules 4–6 × 2–3 mm, oblong, obovate, membranous, red-brown, persistent. *Inflorescences* 1–6 per stem, unisexual, pistillate inflorescences preceding staminate inflorescences; peduncle and pedicels subtended by a stipuliform bract, peduncular bract 1.0–1.3 mm, ovate, pedicellular bracts 0.8–1.3 mm, deltate; staminate inflorescence 1 per axil, 5–45 mm, bearing 5–9 flowers in a single compact head; peduncle ⅔ to ¾ inflorescence length, 0.5 mm diam., glabrous; pedicels 1–2 × 0.5 mm, glabrous; flowers in bud immediately prior to anthesis 2.5–3.5 × 1.5–2.0 mm; tepals 1.0–1.5 mm, 3, ovate, glabrous; subapical appendages 1.5–3.0 mm, narrow ovate, glabrous; stamens 3, filaments 2.0–2.5 mm, anthers 0.5 × 1.0 mm; pistillate inflorescences 1 or 2 per axil, 10–25 mm, bearing 8–20 flowers in a single compact head; peduncle ⅔ to ¾ inflorescence length, 0.5 mm diam., glabrous; pedicels 0.5–0.8 × 0.5 mm, glabrous; flowers 1.0–1.5 × 0.8–1.0 mm, glabrous; tepals 3, unequal, the central one 1.0–1.5 mm, ovate, the lateral two 0.8 mm, lanceolate. *Infructescences* 12–50 mm, peduncle 0.5 mm diam.; fruit 2–3 × 1.5–2.0 mm, asymmetrical, compressed ovoid, glabrous, the margin narrow, thickened.

Distribution. Central Costa Rica at 2500–3200 m, in forest on, or close to riverbanks and by the side of forest tracks, growing on tree trunks and rocks.

Discussion. This species falls within Weddell's *Dentatae* and Killip's *Molles* species groups. Burger (1977: 254) equated this species with *Pilea cornuto-cucullata*, another Costa Rican species. Although no representative collections are cited in *Flora Costaricensis*, collections determined by Burger as *P. cornuto-cucullata* constitute the type collection for *P. tripartita* as well as one of the paratype collections (*Burger & Liesner 6509*).

Pilea tripartita A. K. Monro most closely resembles *P. cornuto-cucullata*, differing as summarized below:

P. cornuto-cucullata: staminate flowers 4-parted, subapical appendage 0.5–1.0 mm; fruit ca. 1.5 mm.

P. tripartita: staminate flowers 3-parted, subapical appendage 1.5–3.0 mm; fruit 2–3 mm.

To a lesser extent, *Pilea tripartita* also resembles *P. fallax* Weddell from western Venezuela, Colombia, and Ecuador, distinguished as outlined below:

P. fallax: stipules auriculate, gray to gray-brown in color; leaves pinnately nerved (no secondary nerves more prominent than the others); pistillate inflorescences bearing 3–7 flowers.

P. tripartita: stipules oblong to obovate, red-brown in color; leaves 3-plinerved; pistillate inflorescences bearing 8–20 flowers.

Paratypes. COSTA RICA. **Limón:** cantón de Talamanca, sendero entre Cerro Dúrika y sabanas de Dúrika, siguiendo el cauce de la quebrada intermitente, 9°24′30″N, 83°18′35″W, 2500 m, 21 Oct. 1989, *Herrera 3752* (BM, MO not seen). **San José-Cartago border:** about 22 km SE of Empalme, along the Interamerican

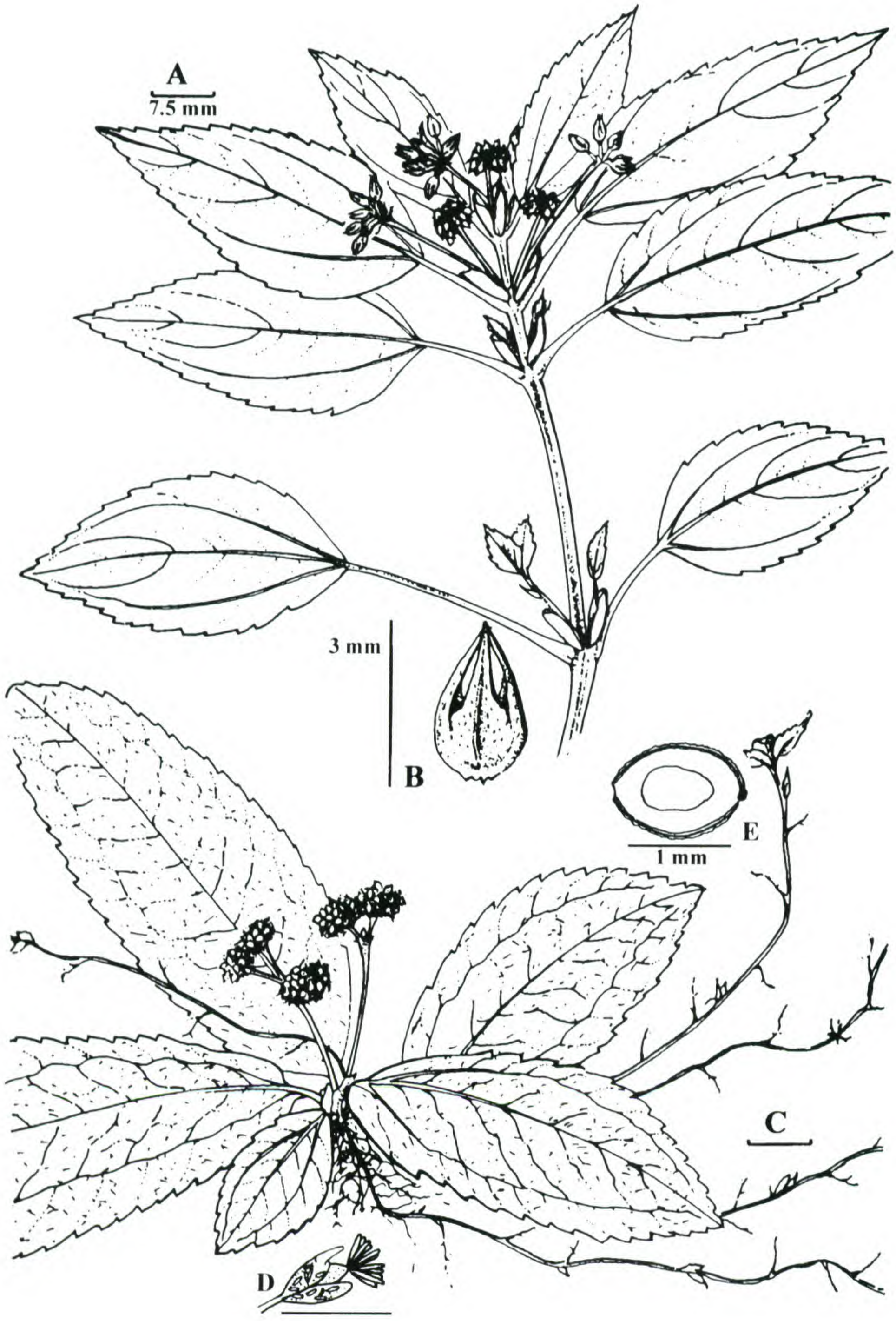

Figure 2. A, B. *Pilea tripartita* A. K. Monro. —A. Habit, plant with staminate inflorescences and infructescences. —B. Staminate flower prior to anthesis. C–E. *Pilea rostulata* A. K. Monro. —C. Habit, plant with infructescences and stoloniferous stems. —D. Pistillate flower. —E. Fruit. A and B based on *Burger & Liesner 6330*. C and E based on *Antonio 1237*. D based on *Mori et al. 6449*.

Highway at 2500–2600 m, 9°40′N, 83°50′W, 27 Nov. 1969, *Burger & Liesner 6509* (F, MEXU).

Pilea rostulata A. K. Monro, sp. nov. TYPE: Panama. Colón: along the Río Guanche, elev. 400 m, 5 July 1979, *Antonio 1237* (holotype, BM; isotype, MO). Figure 2C.

Species *P. involucratae* (Sims) Urban similis, sed caulibus stoloniferis, foliis basi cordatis, floribus pistillatis dorsaliter appendiculatis, differt.

Herb to 10 cm, perennial; epiphytic or epipetric, dioecious or monoecious. *Stems* stoloniferous from rootstock, otherwise unbranched, erect, rooting at base and adventitiously; internodes 2–7 × 1.0–1.5 mm, weakly striate, drying dark brown, pubescent, the hairs to 1 mm, upright or weakly appressed, straight or weakly curved, cystoliths elliptic. *Blades of leaves* at the same node of equal length, petiolate, 17–120 × 10–35 mm, obovate, elliptic, smaller leaves frequently suborbicular, subchartaceous to chartaceous; adaxial surface drying dark green to brown-green, pubescent, the hairs to 1.5 mm, upright, weakly curved or straight, cystoliths fusiform, V-shaped; abaxial surface drying gray-green, pubescent as the adaxial surface, cystoliths disc-shaped, fusiform, V-shaped, punctate glandular; base asymmetrical, cordate; margin serrate, basal ¼ entire; apex symmetrical, obtuse to acute; primary venation 3-plinerved, the two lateral nerves stopping short of the leaf apex, secondary veins 6–10 pairs, 45–65° to the midrib; petioles equal, 2–15 × 0.8–1.0 mm, pubescent, the hairs to 1.5 mm, upright, weakly curved or straight; stipules 4–9 × 2.5–3.5 mm, ovate-oblong, obovate, membranous, pale brown to dark brown, persistent. *Inflorescences* 1 or 2 per stem, unisexual, rarely bisexual, peduncle and pedicels subtended by stipuliform bracts, peduncular bract 1.0 mm, narrowly ovate, pedicellular bracts 0.5–0.8 mm, broadly ovate; staminate inflorescences solitary, 37–55 mm, bearing 12–20 flowers in a compact head; peduncle ¾ to ⅞ inflorescence length, 0.8–1.3 mm diam., glabrous; pedicels 0.8–2.0 × 0.3 mm, glabrous; flowers in bud immediately prior to anthesis 2.8–3.0 × 1.3–1.5 mm, pale green; tepals (2)4, 2.0–2.8 mm, ovate, glabrous; subapical appendages 1.0–1.5 mm, narrowly ovate, glabrous; stamens (2)4, filaments 2.0–2.5 mm, anthers 0.5 × 1.0 mm; pistillate inflorescences 1 or 2, 12–45 mm, bearing 100–250 flowers in a loose panicle or 1–3 compact panicles, rarely with a few staminate flowers; peduncle ⅔ to ¾ inflorescence length, 1.0 mm diam., glabrous; pedicels 0.5–1.0 × 0.1–0.2 mm, glabrous; flowers 0.8–1.0 × 0.4–0.5 mm, glabrous; tepals 3, unequal, glabrous, the central one 0.8–1.0 mm, obovate, with a dorsal subapical appendage 0.5–1.0 mm long, the lateral two 0.8 mm, asymmetrically ovate, lacking any appendages. *Infructescences* 23–60 mm, peduncle 0.5–1.0 mm diam.; fruit 1.3 × 0.8–1.0 mm, symmetrical or asymmetrical, compressed elliptic, orange-brown to dark brown, the margin crenulate, submarginal ridge present.

Distribution. Known only from the Caribbean side of central Panama where it is found growing in damp shady places on, or close to, riverbanks, at an altitude of 0–400 m.

Discussion. This species falls within Weddell's *Dentatae* and Killip's *Molles* species groups. *Pilea rostulata* most closely resembles *P. involucrata*, which is known from Costa Rica to Colombia and Venezuela and the Windward Isles. It differs as summarized below:

P. involucrata: terrestrial, stolons absent; leaf margin crenate, basal ⅓ to ½ entire; leaf base obtuse or attenuate or decurrent; tepals of the pistillate flowers lacking a subapical appendage.

P. rostulata: epiphytic or epipetric, stolons present; leaf margin serrate, basal ¼ entire; leaf base cordate; broader tepal of the pistillate flowers with a dorsal subapical appendage ca. 1 mm in length.

Paratypes. PANAMA. **Colón:** near Río Guanche, 17 July 1971, *Dressler 4056* (BM, MO); Río Guanche, ca. 2.5 km upriver from bridge on road to Portobelo, 3 June 1975, *Mori et al. 6449* (BM, MO); Río Guanche, 2.5 km upstream from the bridge on the road to Portobelo, 27 Aug. 1975, *Mori & Witherspoon 7952a* (MO); walking upstream from bridge over Río Guanche, 0–50 ft., 27 May 1980, *Antonio 4778* (MO); walking upstream from bridge over Río Guanche, 0–50 ft., 27 May 1980, *Antonio 4779* (MO); Río Guanche above bridge on Portobelo Road, ca. 3–5 km above bridge, 50–200 m, 8 July 1976, *Croat 36941* (MO); to Río Iguanita, 390 m, 7 Apr. 1977, *D'Arcy 11254* (MO); S approach to Cerro Bruja from Río Escandaloso, ridge top, 20 May 1978, *Hammel 3216* (MO).

Pilea quadrata A. K. Monro, sp. nov. TYPE: Panama. Colón: along Río Escandaloso near mina boquerón Numero 2, 250 m elev., 14 July 1979, *T. Antonio 1345* (holotype, MO). Figure 3A–C.

Species a *P. ecboliophylla* Donnell Smith inflorescentiis staminalis brevibus, inflorescentiis pistillatis multo paucifloris, differt.

Herb to 25 cm, perennial; terrestrial, epiphytic or epipetric, monoecious. *Stems* erect, repent, sparsely branched, rooting at base and adventitiously where repent; internodes 7–15 × 0.5–0.8 mm, weakly striate, square in cross section, drying gray-green, glabrous, cystoliths elliptic. *Blades of leaves* at the same node of unequal length by ratio 1:4.5–13.0, the major leaves petiolate, 23–51 ×

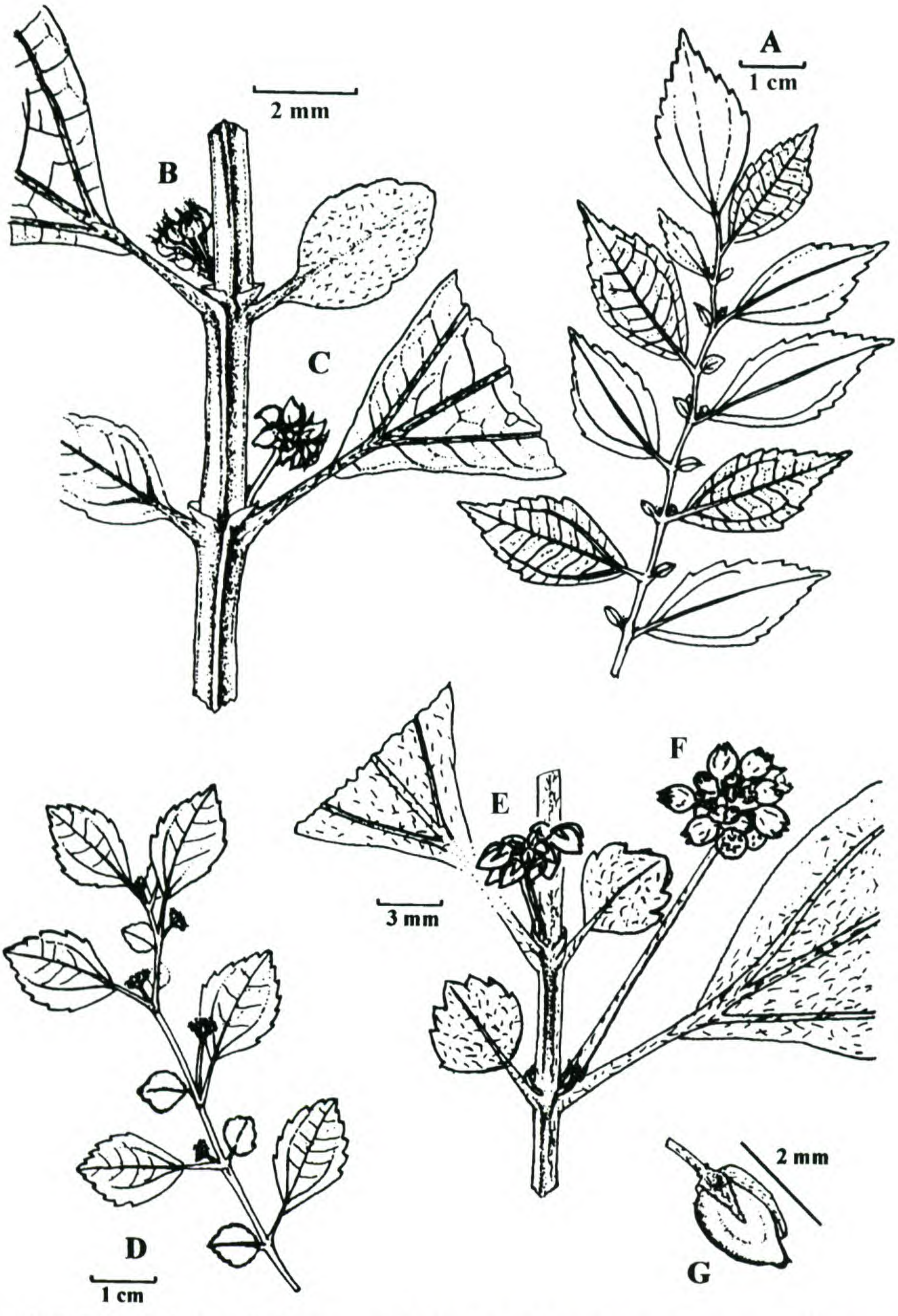

Figure 3. A–C. *Pilea quadrata* A. K. Monro. —A. Habit, plant with staminate inflorescences. —B. Staminate inflorescence. —C. Infructescence. D–G. *Pilea tutensis* A. K. Monro. —D. Habit, plant with staminate inflorescence and infructescences. —E. Infructescence. —F. Staminate inflorescence. —G. Fruit. A based on *Liesner 1195*. B and C based on *Antonio 1345*. D–G based on *Witherspoon et al. 8860*.

11–18 mm, ovate, elliptic, rhomboid, subchartaceous; adaxial surface drying dark gray-green, glabrous, cystoliths fusiform, V-shaped, occasionally Y-shaped; abaxial surface drying pale brown-green or pale gray-green, glabrous, cystoliths fusiform, V-shaped, disc-shaped, occasionally Y-shaped, punctate glandular; base asymmetrical, decurrent and obtuse, decurrent and acute; margin serrate, basal ½ to ⅔ entire; apex symmetrical, acute to weakly acuminate; primary venation 3-nerved or 3-pli-

nerved, the two lateral nerves visible for ½ to ⅔ of the leaf length, secondary veins 6–9 pairs, 65–80° to the midrib, tertiary venation clearly visible; the minor leaves subsessile to sessile, 4–5 × 2 mm, elliptic, ovate, obovate, the leaf base strongly asymmetrical, decurrent and obtuse or cuneate, the leaf apex asymmetrical, acute to obtuse, otherwise as major leaves; petioles of the major leaves 1.5–2.5 × 0.5–0.8 mm, glabrous; stipules 0.5–0.8 × 0.8 mm, ovate, membranous, brown, persistent. *Inflorescences* 2–30 per stem, unisexual, pistillate inflorescences concurrent with staminate inflorescences, peduncle and pedicels subtended by stipuliform bracts, peduncular bract 0.3–0.5 mm, ovate, obscure, pedicellular bracts 0.3–0.5 mm, narrowly ovate; staminate inflorescences solitary, 1.5–2.0 mm, bearing 5–12 flowers in a compact head, appearing fasciculate; peduncle ¼ inflorescence length, glabrous; pedicels 0.8–1.5 mm, glabrous; flowers in bud immediately prior to anthesis 0.8–1.0 × 0.8–1.0 mm, cream; tepals 4, 1 mm, ovate, glabrous; subapical appendages 0.3–0.5 mm, corniculate, glabrous; stamens 4, filaments 1 mm, anthers 0.5 × 0.8 mm; pistillate inflorescence solitary, 1.0–2.5 mm, bearing 5–8 flowers in a compact head; peduncle ¼ to ½ inflorescence length, 0.3 mm diam., glabrous; pedicels 0.3 × 0.3 mm to inconspicuous, glabrous; flowers ca. 0.5 × ca. 0.3 mm, glabrous; tepals 3, unequal, the central one 0.5 mm, ovate to oblong, the lateral two 0.3–0.5 mm, asymmetrically ovate. *Infructescences* ca. 2.5 mm, peduncle ca. 0.3 mm diam.; fruit ca. 1.0 × 0.8 mm, symmetrical, compressed, elliptic, the margin not thickened.

Distribution. Central Panama, forest understory and riverbanks at 200–500 m.

Discussion. This species falls within Weddell's *Heterophyllae* and Killip's *Centradenioideae* species groups. *Pilea quadrata* most closely resembles *P. ecboliophylla*, which is found throughout Mesoamerica. They differ as summarized below:

P. ecboliophylla: stem an irregular circle in cross section; staminate inflorescences 6–25 mm, bearing 24–60 flowers, appearing paniculate; pistillate inflorescences bearing 12–200 flowers.

P. quadrata: stem square to rhombic in cross section; staminate inflorescences 1.5–2.0 mm, bearing 5–12 flowers, appearing fasciculate; pistillate inflorescences bearing 5–8 flowers.

Paratypes. PANAMA. **Panamá:** along El Llano–Cartí–Tupile road, 12 mi. above Pan-American Hwy., 200–250 m, 26–27 Mar. 1973, *Liesner 1195* (GH, MO, US); El Llano to Cartí Road, 13.7 km N of Pan-American Highway, San Blas border, 1 June 1977, *Folsom 3498* (MO); El Llano to Cartí Road, 12 km N of Pan-American Highway at El Llano, ca. 400 m, 11 Mar. 1974, *Nee 10452* (US).

Pilea tutensis A. K. Monro, sp. nov. TYPE: Panama. Veraguas: Cerro Tute, slopes up to 4000 ft., trail past agricultural school near Santa Fé, 17 Sep. 1979, *T. Antonio 1845* (holotype, MEXU; isotypes, MO, NY). Figure 3D–G.

Species *P. tilaranae* W. Burger similis, sed floribus staminalis plurimis, pedicellis florium staminalium longioribus, petiolio foliorum minorum longioris.

Herb to 35 cm, perennial; terrestrial, epiphytic, monoecious. *Stem* erect, repent, sparsely branched, rooting at base and adventitiously where repent; internodes 6–17 × 0.8–1.0 mm, weakly striate, drying dark brown, glabrous; cystoliths elliptic. *Blades of leaves* at a node of unequal length by ratio 1:2–4; the major leaves petiolate, 19–30 × 11–18 mm, elliptic, obovate, chartaceous; adaxial surface drying dark brown to green-brown, glabrous, cystoliths fusiform; abaxial surface drying brown, glabrous, cystoliths fusiform, punctate glandular; base asymmetrical or symmetrical, cuneate, acute, weakly decurrent; margin crenate, basal ¼ to ⅓ entire; apex symmetrical, obtuse, weakly acuminate; primary venation 3-plinerved, the two lateral nerves visible for ⅔ of the leaf length, secondary veins 4–10 pairs, 65–90° to the midrib; the minor leaves petiolate, 6.0–9.5 × 3–7 mm; suborbicular to broad elliptic, otherwise as major leaves; petioles unequal by ratio 1:3.5–6, of the major leaf 4–12 × 0.8 mm, of the minor leaf 1–2 × 0.5 mm, glabrous; stipules 0.5–0.8 × 0.5–0.8 mm, broadly ovate to deltate, membranous, brown, persistent. *Inflorescences* 6–18 per stem, unisexual, pistillate inflorescences preceding or concurrent with staminate inflorescences, peduncle and pedicels subtended by stipuliform bracts, peduncular bract 0.30–0.8 mm, ovate to narrow ovate, pedicellular bracts 0.5 mm, narrowly deltate; staminate inflorescences solitary, 17–22 mm, bearing 50–80 flowers in a single compact head; peduncle ¾ inflorescence length, 0.5 mm diam., glabrous; pedicels 0.5–1.0 × 0.1 mm, glabrous; flowers in bud immediately prior to anthesis 1.8–2.0 × 1.0 mm, cream, apically green; tepals 4, 2 mm, ovate, glabrous; subapical appendages ca. 0.8 mm, corniculate; stamens 4, filaments ca. 1.5 mm, anthers ca. 0.5 × ca. 1.0 mm; pistillate inflorescences solitary, 2–4 mm, bearing flowers in a semi-compact to compact head; peduncle ⅓ to ½ inflorescence length, 0.1–0.3 mm diam., glabrous; pedicels 0.5–0.8 mm, glabrous; flowers 1.0–1.3 × 0.5–0.8 mm, glabrous; tepals 3, unequal, the central one 0.8–1.0 mm, oblong, the lateral two 0.5–0.8 mm, asymmetrically ovate. *Infructescences* 4–15

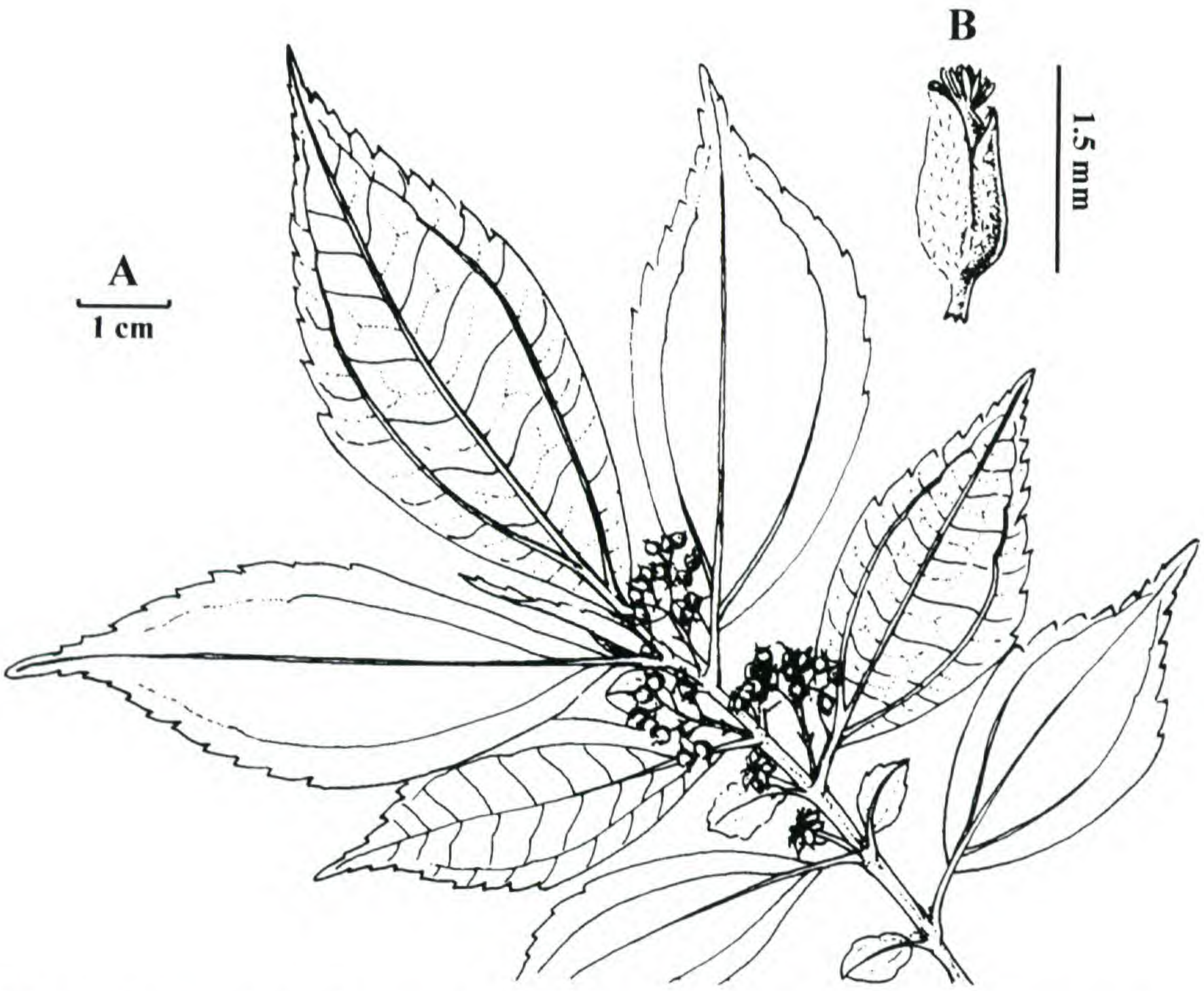

Figure 4. *Pilea magnicarpa* A. K. Monro. —A. Habit, plant with staminate inflorescences and infructescences (infructescences toward the base). —B. Pistillate flower. A and B based on *Hammel 4014*.

mm, peduncle 0.5 mm diam.; fruit 1.8–2.5 × 1.0–1.5 mm, asymmetrical, compressed ovoid, the margin dorsally thickened and ventrally flattened.

Distribution. Cerro Tute of the Cordillera Central in Central Panama, in forested and open areas at 900–1600 m.

Discussion. This species falls within Weddell's *Heterophyllae* and Killip's *Centradenioideae* species groups. *Pilea tutensis* most closely resembles *P. tilarana* from Costa Rica, differing as indicated below:

P. tilarana: minor leaf subsessile with petioles less than 0.3 mm; staminate inflorescences with ca. 15 flowers, staminate pedicel 1.3–1.5 mm.

P. tutensis: minor leaf petiole 1–2 mm; staminate inflorescences with 50–80 flowers, staminate pedicel 0.5–1.0 mm.

Paratypes. PANAMA. **Veraguas:** vicinity of Escuela Agrícola Alto Piedra near Santa Fé, 0.3 mi. beyond fork in road near the school, toward Atlantic slope, along trail to top of Cerro Tute, 3500–4100 ft., 30 Nov. 1979, *Antonio 2976* (MO); vicinity of Escuela Agrícola, Alto Piedra near Santa Fé .3 mi. beyond the fork in the road near the school, toward Atlantic slope along trail to top of Cerro Tute, 3200–3400 ft., 26 Jan. 1980, *Antonio 3486* (MO); along steep trail to summit of Cerro Tute ca. 3 km above Escuela Agrícola Alto Piedra near Santa Fé, 3000–3100 ft., 4 Jan. 1981, *Sytsma & Antonio 3059* (MO); Cerro Tute, E slopes, 1 km beyond Escuela Agrícola Alto Piedra above Santa Fé, low cloud forest, 900–1200 m, 14 May 1981, (MO); trail up E side of Cerro Tute, to 1200 m, 25 Oct. 1975, *Witherspoon et al. 8860* (MO, NY); trial on ridge to summit of Cerro Tute, Cordillera de Tute, 1 km past Escuela Agrícola Altos de Piedras, W of Santa Fé, 8°36′N, 81°06′W, 15 Dec. 1981, *Knapp & Sytsma 2600* (MO); Cerro Tute, W-slopes, forest, 850 m, 23 Oct. 1980, *Maas & Dressler 5030* (F); forested mountains W of Alto de Piedras W of Santa Fe, 3200–5600 ft., 8 Sep. 1978, *Hammel 4592* (MO).

Pilea magnicarpa A. K. Monro, sp. nov. TYPE: Panama. Coclé: El Copé, on slope and ridge W of sawmill, 5 Apr. 1978, *B. Hammel 2424* (holotype, MO; isotype, NY). Figure 4A, B.

Species *P. ecboliophyllae* Donnell Smith similis, sed inflorescentiis pistillatis longioribus, floribus pistillatis majoribus, seminibus majoribus, differt.

Herb to 60 cm, perennial; terrestrial, epiphytic or epipetric; monoecious. *Stems* erect, repent, sparsely branched, rooting at base and adventitiously where repent; internodes 7–30 × 1.5–3.0 mm, striate, drying dark brown to almost black, glabrous, cystoliths pusticulate. *Blades of leaves* at the same node of unequal length by ratio of 1:3–13, the major leaves petiolate, 32–170 × 7–65 mm, obovate, oblong, elliptic, chartaceous; adaxial surface drying green, dark green, dark brown, glabrous, cystoliths fusiform; abaxial surface drying

brown to pale green, glabrous, cystoliths fusiform, eglandular, occasionally punctate glandular; base asymmetrical, acute, cuneate, decurrent, subcordate; margin serrate, basal ⅓ to ⅔ entire; apex symmetrical, acuminate; primary venation 3-plinerved, the two lateral nerves stopping short of the leaf apex, secondary veins 8–25 pairs, 80–90° to the midrib; the minor leaves petiolate to subsessile, 7–23 × 4.5–7.0 mm, ovate, elliptic, or obovate, the margin entire or apically serrate, the apex asymmetrical, acute, obtuse, occasionally cuspidate, otherwise as major leaves; petioles unequal by ratio of 1:4–10, of the major leaves 2–10 × 1.0 mm, of the minor leaves 0.3–1.0 × 0.3–0.5 mm to inconspicuous, glabrous; stipules 0.5–1.5 × 1.0–2.5 mm, deltate, membranous, brown to gray-brown, glabrous, persistent. *Inflorescences* 3–18 per stem, unisexual, pistillate inflorescences preceding or concurrent with staminate inflorescences, peduncle and pedicels subtended by stipuliform bracts, peduncular bract 0.5–1.5 mm, ovate, pedicellular bracts 0.5–0.8 mm, narrowly ovate; staminate inflorescences solitary, 5–35 mm, bearing 11–50 flowers in a loose panicle; peduncle ⅓ to ½ inflorescence length, 0.5–0.8 mm diam., glabrous; pedicels 1–2 × 0.3 mm, glabrous; flowers in bud immediately prior to anthesis 1.5–2.0 × 1.0–1.5 mm, cream, apically green; tepals 4, 2.0–2.5 mm, obovate, glabrous; subapical appendages 0.5–1.0 mm, corniculate, glabrous; stamens 4, filaments ca. 1.0 mm, anthers ca. 0.5 × ca. 1.0 mm; pistillate inflorescences 1 or 2 per axil, 7–30 mm, bearing 4–30 flowers in a semi-compact head; peduncle ⅔ inflorescence length, ca. 0.5 mm diam., glabrous; pedicels 0.5–0.8 × 0.3–0.5 mm, glabrous; flowers 1.0–1.8 × 0.5–0.8 mm, glabrous; tepals 3, unequal, the central one 1–2 mm, oblong to spatulate, the apex reflexed, the lateral two 0.8–1.5 mm, ovate, the apex not reflexed. *Infructescences* 15–30 mm, peduncle 0.5 mm diam.; fruit 2.0–2.5 × 1.5 mm, compressed ovoid, the margin apically and ventrally flattened.

Distribution. Forest at an altitude of 350–1400 m in Coclé, Panamá, and San Blas departments of central Panama.

Discussion. This species falls within Weddell's *Heterophyllae* and Killip's *Centradenioideae* species groups. *Pilea magnicarpa* most closely resembles *P. ecboliophylla*, which is found throughout Mesoamerica; it may be distinguished from the latter as summarized below:

P. ecboliophylla: V- and Y-shaped cystoliths present on adaxial leaf surface, abaxial surface minute punctate glandular; pistillate inflorescences 1–4 mm; infructescences 2.5–6.0 mm, fruits 0.8–1.0 mm.

P. magnicarpa: V- or Y-shaped cystoliths absent, abaxial leaf surface eglandular, rarely punctate glandular; pistillate inflorescences 7–30 mm; infructescences 15–30 mm, fruit 2.0–2.5 mm.

To a lesser extent this species also resembles *P. chiriquina* Killip from Costa Rica and Panama, but may be distinguished as outlined below:

P. chiriquina: staminate flowers 15–200 per inflorescence, borne in 1–4 compact heads; pistillate inflorescences 2.0–8.5 mm.

P. magnicarpa: staminate flowers 11–40 per inflorescence, borne in a loose panicle; pistillate inflorescences 7–30 mm.

Paratypes. PANAMA. **Coclé:** El Copé, along gravel road to the right before sawmill, 2400 ft., 18 Oct. 1979, *Antonio 2180* (MO); road to Fortuna Dam site N of Gualaca, 22.7 mi. beyond the bridge over Río Estí, 1400 m, 22 Nov. 1979, *Antonio 2767* (MO); Alto Calvario cloud forest, 5.3 m above El Copé, above sawmill, on continental divide, 930 m, 6 Dec. 1979, *Antonio 3035* (MO); vicinity El Copé, 5–6 mi. N of El Copé, along trail which leads into the lowlands from old Riviera saw works area, 08°38′N, 08°35′W, 600–800 m, 8 July 1994, *Croat & Zhu 77220* (BM, MO not seen); 7 km N of El Copé de Veraguas, circa Rivera sawmill, Alto Calvario, ca. 900 m, continental divide at 1300 m, 11 Jan. 1977, *Folsom 1212* (MO); lumber camp at Alto Calvario, 7 km N of El Copé, ca. 900 m, 14 Jan. 1977, *Folsom 1266* (MO); summit, Alto Calvario, 7+ km N of El Copé, 850 m, 19 May 1977, *Folsom & Button 3288* (MEXU, MO not seen); near continental divide along lumbering road 8.4 km above El Copé (1 km beyond sawmill), 900 m, 19 Jan. 1978, *Hammel 950* (MO); near continental divide along lumbering road, 2.2 km beyond sawmill in forest along lumber road above El Copé, 900 m, 20 Jan. 1978, *Hammel 1031* (MO); along road from La Pindeda to El Copé by way of Piedras Gordas, sawmill above El Copé cloud forest, 3000 ft., 20 Apr. 1978, *Hammel 2613* (MO); continental divide on road to Coclecito, in patch of forest near road, 1500 ft., 20 June 1978, *Hammel 3481* (MO); continental divide N of Penonome on road to Coclesito small patch of forest at roadside, 1600 ft., 25–26 July 1978, *Hammel 4014* (MO); sawmill above El Copé, in forest along stream E of sawmill, Atlantic drainage, 2300 ft., 27 July 1978, *Hammel 4138* (MO). **Panamá:** Llano–Cartí road, 1 mi. past sawmill on dirt road, 11 Nov. 1979, *Antonio 2550* (BM, MO). **San Blas:** El Llano–Cartí road, 12 mi. from Pan American Highway, along deeply shaded large stream, 350–400 m, 10 May 1981, *Sytsma & Andersson 4495* (MO).

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Seis Nuevas Especies de *Vriesea* sect. *Xiphion* (Bromeliaceae: Tillandsoideae) para Costa Rica

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RESUMEN. Se describen y se ilustran seis nuevas especies de *Vriesea* sect. *Xiphion* para Costa Rica: *V. barii*, *V. haberii*, *V. osaensis*, *V. simulans*, *V. tiquirensis* y *V. vulcanicola*. Se discuten sus relaciones dentro del género. Todas son endémicas por el momento.

ABSTRACT. Six new species of *Vriesea* from Costa Rica, *V. barii*, *V. haberii*, *V. osaensis*, *V. simulans*, *V. tiquirensis*, and *V. vulcanicola*, are described and illustrated. In addition, their relationships are discussed. All are endemic as far as is known.

El género *Vriesea* (Bromeliaceae: Tillandsoideae) comprende alrededor de 250 especies distribuidas en las regiones húmedas del neotrópico (Utley & Utley, 1994). A nivel de Mesoamérica, Costa Rica y Panamá presentan un centro de diversidad bastante alto, donde aproximadamente 60 especies son encontradas, 43 de ellas endémicas y confinadas a la Cordillera de Talamanca y sus estribaciones.

Como resultado de la elaboración del tratamiento de Bromeliaceae para el Proyecto Manual de las Plantas de Costa Rica, fueron encontradas seis nuevas especies de *Vriesea* subgénero *Vriesea* sección *Xiphion*. Esta sección se caracteriza por sus flores con los estambres incluidos y brácteas mayormente verde pálido o marrón (Smith & Downs, 1977).

A pesar de recientes tratamientos taxonómicos en los cuales se da reconocimiento genérico a varias secciones dentro de *Vriesea* (Grant, 1995; Grant & Zijlstra, 1998), yo prefiero seguir la clasificación establecida por Smith y Downs (1977) hasta que se proponga una evaluación integral de *Vriesea* y los géneros más cercanamente relacionados, *Tillandsia* y *Guzmania*, debido a la problemática delimitación entre estos y algunas de sus secciones.

Vriesea barii J. F. Morales, sp. nov. TIPO: Costa Rica. Cartago: Cantón de El Guarco, Valle del Reventazón, La Sierra, cabeceras Río Estrella, 1800–2100 m, 18 abr. 1994, *Morales 3329* (holótipo, INB 2 láminas). Figura 1.

A *Vriesea macrantha* Mez & Wercklé, cui affinis, bracteis florigeris et inflorescentia permajoribus differt; a *V. bicolor* L. B. Smith bracteis florigeris rugosis non secundis differt.

Epífitas, raramente terrestres; plantas en floración 60–70 cm alto. Hojas rosuladas, moderamente extendidas, (39–)48–65 cm largo, punteado-lepidotas, especialmente en la cara abaxial, cartáceas, verdes a moradas abaxialmente. Vainas de las hojas anchamente elípticas, 13–17 × 7–8.5 cm, canela-marrón, a veces con una mancha café oscuro cerca de la base, moderadamente punteado-lepidotas, especialmente en la cara abaxial. Láminas de las hojas liguladas, 3.5–5 cm ancho, acuminadas. Escapo erecto, 18.5–21 cm × 5–8 mm, marrón claro. Brácteas del escapo erectas, 6.5–9 cm largo, más largas que los entrenudos, densamente imbricadas, las distales café-marrón, las proximales verde-canela. Inflorescencia simple, erecta, 30–43.5 × 4–5.5 cm, dística (aún en fructificación), multíflora. Brácteas primarias como las brácteas del escapo, más largas que los entrenudos, marrón oscuro. Brácteas florales 5–6.5 cm largo, anchamente ovadas, obtusas a agudas, imbricadas y coriáceas, ecarinadas, rugosas, marrón oscuro. Pedicelos 7–9 × 5–6 mm. Sépalos 2.7–4 cm largo, obovados, subcoriáceos, canela. Pétalos blancos con los bordes morado, 6–7 cm largo, angostamente obovados, obtusos, con dos escamas basales. Frutos cápsulas cilíndricas, 2.5–3.2 cm, más cortas o igualando los sépalos, ocultas dentro de las brácteas florales; coma de la semilla crema a blanco-crema.

Distribución. *Vriesea barii* está restringida a la Cordillera de Talamanca en Costa Rica, entre 1700 y 2100 m, donde se encuentra en áreas alteradas (pastizales) y en el dosel superior de bosques primarios o intervenidos.

Fenología. Florece de abril a junio; fructifica de septiembre a diciembre.

Esta especie se encuentra bastante relacionada con el complejo de especies de *Vriesea gladioliflora* (H. Wendland) Antoine; sin embargo, es fácilmente separable de esta especie por el color castaño oscuro de sus brácteas, cápsulas muy pequeñas, totalmente ocultas dentro de las brácteas al madurar

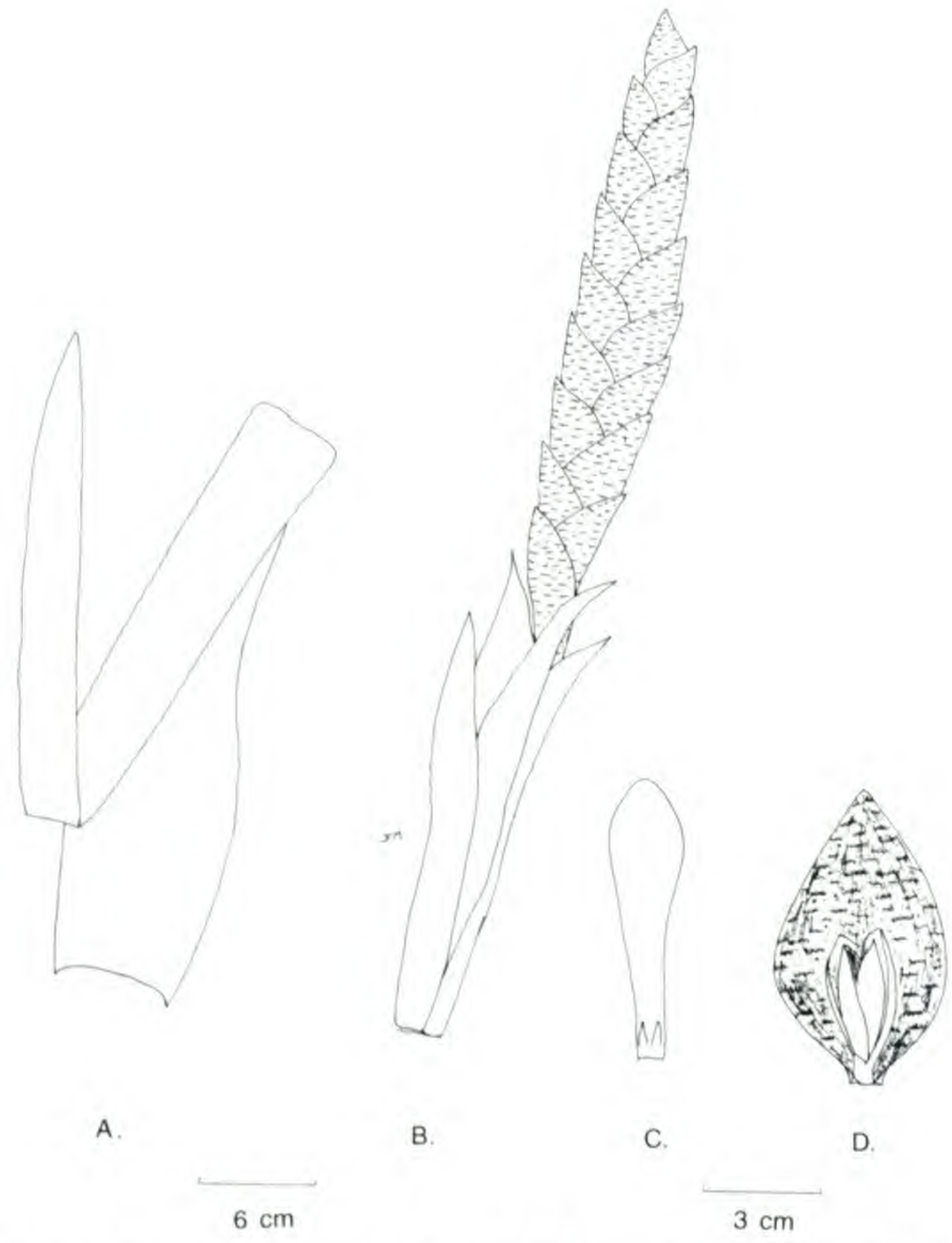

Figura 1. A–D. *Vriesea barii* J. F. Morales (*Morales 3329*, INB). —A. Hoja. —B. Inflorescencia. —C. Pétalo mostrando las escamas basales. —D. Sépalos y frutos.

y distribución altitudinal. Generalmente, *V. gladioliflora* es muy común en zonas bajas, donde se le encuentra desde nivel del mar hasta los 1300 m; sin embargo, esta especie prácticamente desaparece sobre los 1500 m y a pesar del continuo trabajo de campo que he realizado en los ultimos años, nunca he encontrado poblaciones sobre esa faja altitudinal. Algunas veces, especímenes de *V. ampla* L. B. Smith sobre los 2000 m han sido identificados erróneamente como *V. gladioliflora.*

Vriesea barii se distingue de *V. macrantha* Mez & Wercklé por sus brácteas e inflorescencia más larga. Asimismo, puede ser confundida con *V. bicolor* L. B. Smith, pero se distingue por sus brácteas no unilaterales y conspicuamente rugosas. De *V. ampla* L. B. Smith se reconoce por sus inflorescencias dísticas, aún en fructificación, erectas y nunca arqueadas y por los frutos totalmente ocultos dentro de las brácteas florales.

El epiteto honra a Alvaro "Bari" Fernández, quién fue el primero en descubrir esta especie, como reconocimiento por su trabajo como recolector de especímenes científicos y por la amistad personal que nos une.

Parátipos. COSTA RICA. **Cartago:** Cordillera de Talamanca, Fila Alto Indias, cerca del cruce a Casamata, *Morales 4907* (INB, SEL); Cordillera de Talamanca, Vuelta Ventolera, 2 km S de Casamata, *Morales et al. 5387* (INB). **Limón:** Cantón de Talamanca, Cordillera de Talamanca, Río Coén, Ujarrás a San José Cabecar, *Fernández 1052* (INB).

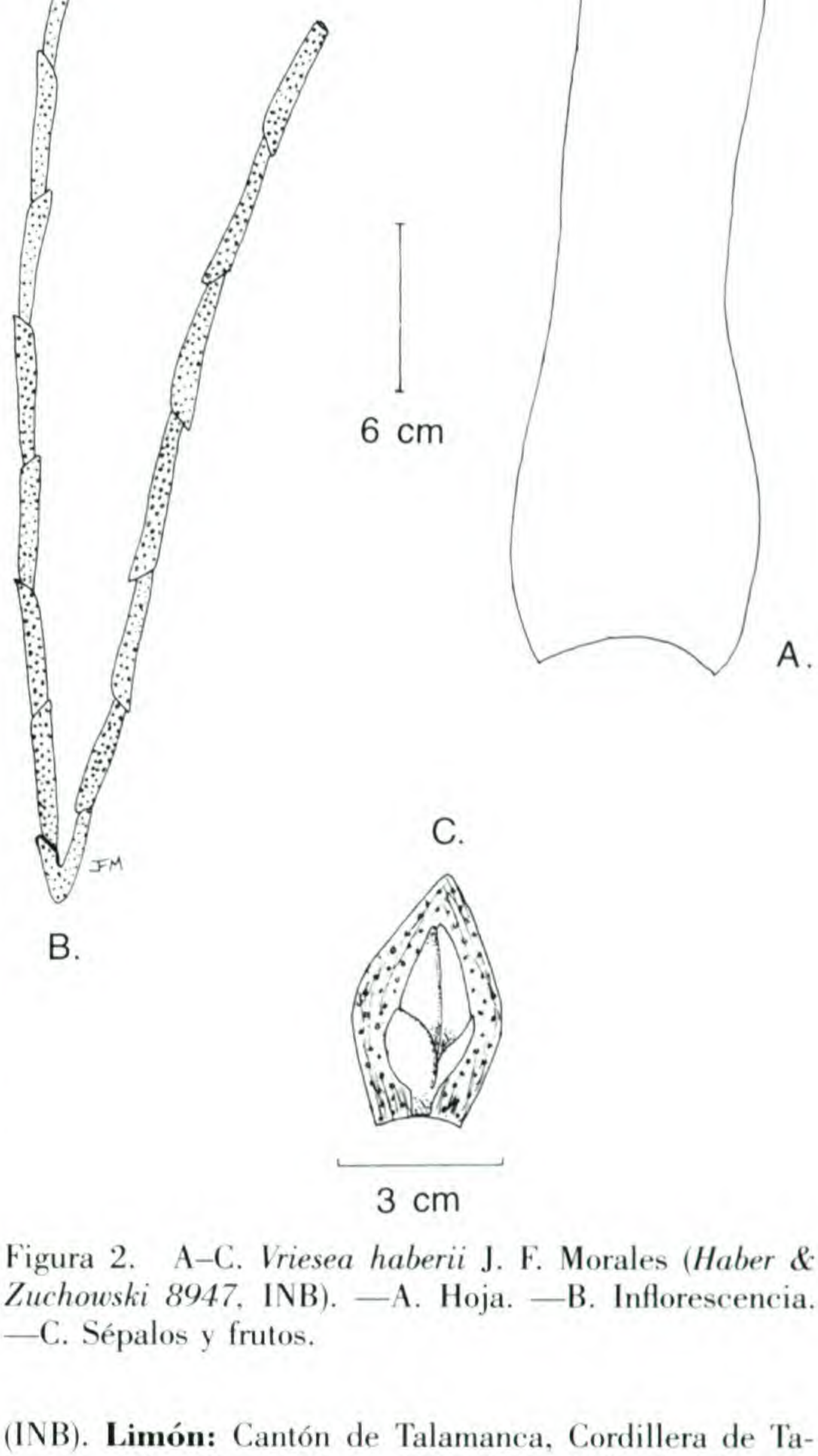

Figura 2. A–C. *Vriesea haberii* J. F. Morales (*Haber & Zuchowski 8947*, INB). —A. Hoja. —B. Inflorescencia. —C. Sépalos y frutos.

Vriesea haberii J. F. Morales, sp. nov. TIPO: Costa Rica. Guanacaste: Cantón de Abangares, 5 km N Monteverde, western margin of Reserva Biológica Monteverde, junction of road to San Gerardo valley with Río Negro, 1550 m, 23 Dec. 1988, *Haber & Zuchowski 8947* (holótipo, INB 2 láminas). Figura 2.

A *Vriesea acuminata* Mez & Wercklé, cui affinis, bracteis florigeris rugosis papillosis differt; a *V. burgeri* L. B. Smith bracteis florigeris rugosis papillosis et non secundis differt.

Epífitas; plantas en floración hasta 65 cm alto. Hojas rosuladas, moderamente extendidas, (25–)34–42 cm largo, esparcida a moderadamente punteado-lepidotas, especialmente en la cara abaxial, cartáceas, verdes a variegadas con morado. Vainas de las hojas anchamente elípticas, 7–9 × 7–8.5 cm, canela, a veces con una leve banda basal café oscuro, moderadamente punteado-lepidotas, especialmente en la cara abaxial. Láminas de las hojas liguladas, 6–6.7 cm ancho, acuminadas. Escapo erecto, 70–76 cm × 5 mm, marrón claro. Brácteas del escapo erectas, 4.5–5.5 cm largo, más largas que los entrenudos, imbricadas, marrón, densamente rugoso-papilosas, opacas. Inflorescencia simple, erecta, 17.5–19.5 cm largo, dística, con 15–18 flores. Brácteas primarias como las brácteas del escapo, más largas que los entrenudos, marrón oscuro. Brácteas florales 3.5–4.1 cm largo, anchamente elípticas, agudas, algo imbricadas antes de la antésis, patentes a levemente ascendentes en fructificación y subcoriáceas, ecarinadas, conspicuamente rugoso-papilosas, marrón. Pedicelos 3–4 × 3 mm. Sépalos 1.4–1.6 cm largo, anchamente ovados, subcoriáceos, marrón. Corola desconocida. Frutos inmaduros cápsulas 2.5–3.1 cm largo, moderadamente acuminadas hacia el ápice; coma de la semilla canela.

Distribución. Costa Rica, en bosques muy húmedos de la Cordillera de Tilarán (Valle de San Gerardo), 1500–1700 m.

Fenología. Se encuentra en fructificación entre noviembre y enero.

Vriesea haberii se encuentra algo relacionada con *V. acuminata* Mez & Wercklé, pero es fácilmente separable por sus brácteas florales y brácteas del escapo conspicuamente rugoso-papilosas, marrón opaco. La colección tipo fue previamente identificada como *V. burgeri* L. B. Smith; sin embargo, difiere de esta especie por sus brácteas florales no secundas en la antésis, dísticas a ligeramente secundas en fructificación y brácteas del escapo rugoso-puncticuladas.

Vriesea osaensis J. F. Morales, sp. nov. TIPO: Costa Rica. Puntarenas: Cantón de Golfito, Jiménez, Dos Brazos de Río Tigre, Cerro Mueller, cuenca superior del Río Rincón, 744 m, 26 ago. 1990, *Herrera 4144* (holótipo, INB). Figura 3.

A *Vriesea viridiflora* (Regel) Wittmack ex Mez, cui affinis, bracteis florigeris et sepalis majoribus, inflorescentia non secunda differt.

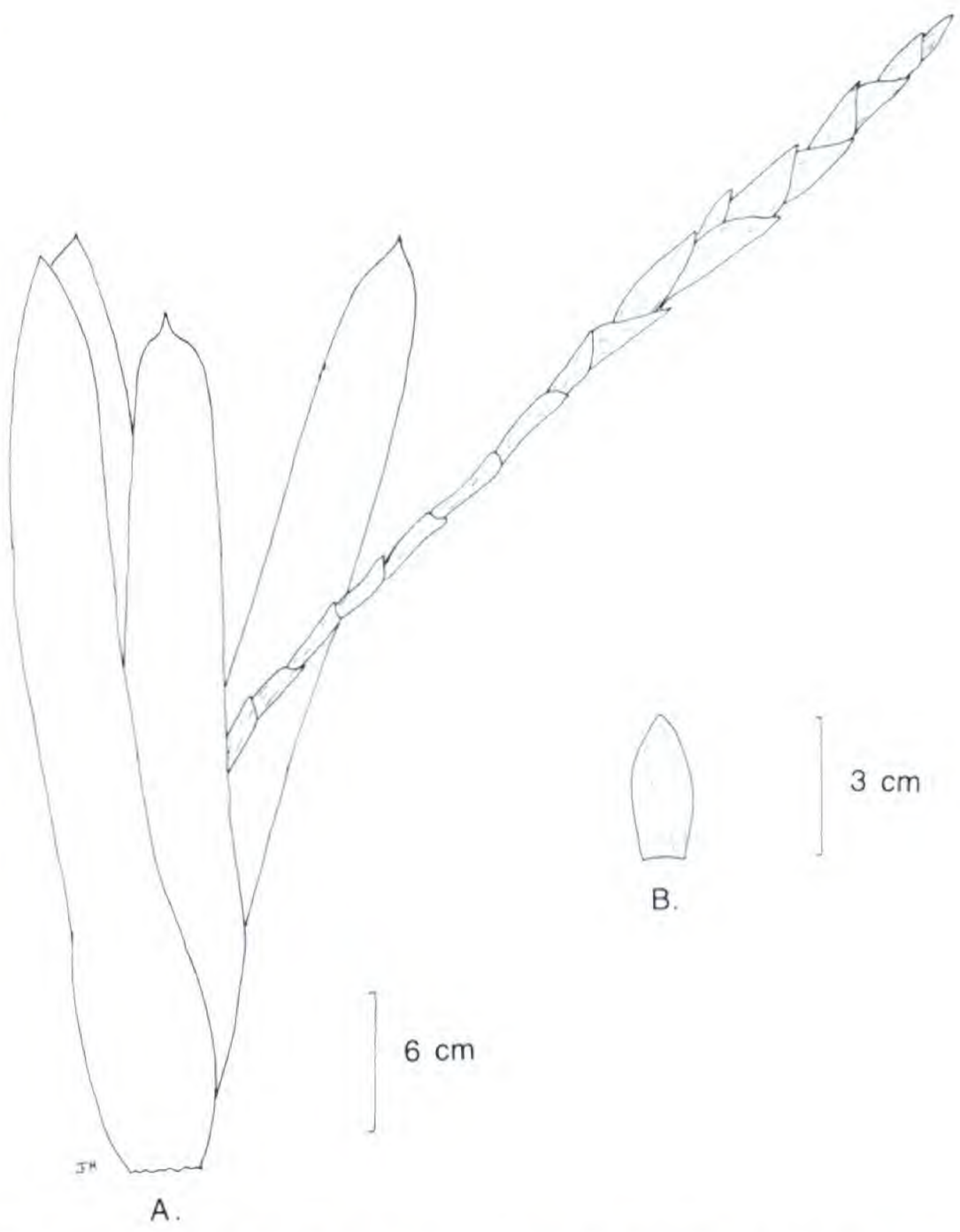

Figura 3. A, B. *Vriesea osaensis* J. F. Morales (*Herrera 4144*, INB). —A. Hábito. —B. Sépalos.

Epífitas; plantas en floración 40–60 cm alto. Hojas rosuladas, moderamente extendidas, 27–73 cm largo, moderada a densamente lepidotas, especialmente en la cara abaxial, cartáceas, verdes. Vainas de las hojas anchamente elípticas, 4.5–7.5 × 3–5 cm, canela a concoloras con la lámina, lepidotas, especialmente en la cara abaxial. Láminas de las hojas liguladas, (1.4–)2.5–3.8 cm ancho, acuminadas a subredondeadas y apiculadas, glabradas a esparcidamente lepidotas. Escapo erecto y arqueado, 29–40 cm × 4–6 mm, canela. Brácteas del escapo erectas, 3.8–4.5 cm largo, ligeramente más largas que los entrenudos, apenas imbricadas, verdes. Inflorescencia simple, erecta, (8–)12–22 × ca. 2 cm, dística (aún en fructificación), con 4–7 flores. Brácteas primarias como las brácteas del escapo, más largas que los entrenudos, verdes. Brácteas florales 4–5.3 cm largo, anchamente elípticas, agudas, densamente imbricadas y subcoriáceas, ecarinadas, lisas a levemente rugulosas, verdes. Pedicelos 2–4 × 2–3 mm. Sépalos 3–3.4 cm largo, elípticos, subcartáceos, verdes. Pétalos crema, 4.7–5.2 cm largo, angostamente obovados, obtusos, con dos escamas basales. Frutos cápsulas cilíndricas y obtusas apicalmente, 3.4–3.7 cm, ocultas dentro de las brácteas florales a ligeramente visibles; coma de la semilla blanco-crema.

Distribución. Costa Rica, en bosques muy húmedos de la Península de Osa, Golfito y en las fajas costeñas del cantón de Puriscal, Provincia de San José, entre 0 y 750 m.

Fenología. Se encuentra en floración entre agosto y septiembre; fructifica de octubre a marzo.

Vriesea osaensis ha sido anteriormente identificada como *V. viridiflora* (Regel) Wittmack ex Mez; sin embargo, difiere de esta especie por sus brácteas y sépalos conspicuamente más largos e inflorescencia dística, no unilateral. En adición, *V. viridiflora* se encuentra en bosques nubosos muy húmedos entre los 900 y 1800 m.

Parátipos. COSTA RICA. **Puntarenas:** Parque Nacional Corcovado, estación Los Patos, *Aguilar 2227* (INB); Cantón de Golfito, Río Esquinas, *Induni 194* (INB); Reserva Forestal Golfo Dulce, Albergue Cerro de Oro, Sendero Los Patos, *Mora 83* (INB, SEL); Reserva Forestal Golfo Dulce, Bahía Rincón, Rincón, *Morales 1915* (INB); Cantón de Osa, Rancho Quemado, *Morales & Hammel 3138* (INB). **San José:** Cantón de Puriscal, Zona Protectora La Cangreja, Mastatal de Puriscal, *Morales 741* (INB).

Vriesea simulans J. F. Morales, sp. nov. TIPO: Costa Rica. Alajuela: Cantón de San Ramón, Reserva Forestal San Ramón, 1000 m, 17 abr. 1994, *Morales & Lépiz 2704* (holótipo, INB; isótipos, MO, SEL). Figura 4.

A *Vriesea kupperiana* Suessenguth et *V. werckleana* Mez, cui affinis, bracteis florigeris majoribus imbricatis non secundis differt.

Epífitas, terrestres o rupícolas; plantas en floración hasta 200 cm alto. Hojas rosuladas, extendidas, 91–105 cm largo, punteado-lepidotas, especialmente en la cara abaxial, cartáceas, verdes. Vainas de las hojas anchamente elípticas, 20–25 × 11.5–15 cm, marrón oscuro, densamente punteado-lepidotas, especialmente en la cara abaxial. Láminas de las hojas liguladas, 9–10 cm ancho, acuminadas. Escapo erecto, algunas veces levemente arqueado, 60–110 cm × 19–26 mm, canela-marrón. Brácteas del escapo erectas, 10–13 cm largo, más largas que los entrenudos, densamente imbricadas, basalmente marrón oscuro, apicalmente verde-canela. Inflorescencia compuesta, bipinada con 5–7 ramos laterales, erecta, 65–80 × 60 cm en diámetro, todas las ramas laterales emergiendo agrupadas en aproximadamente 15–20 cm, multíflora. Brácteas primarias como las brácteas del escapo, más cortas que la base estéril de las ramas laterales. Ramas laterales arqueadas y algo pendulosas distalmente, 30–65 cm largo, con abundante secreción acuosa, brácteas florales y flores dísticas. Brácteas florales 3.6–4.4 cm largo, anchamente elípticas a anchamente ovadas, obtusas a agudas, densamente imbricadas y coriáceas, las proximales carinadas, el resto ecarinadas, lisas a rugulosas, verdes en la antésis, tornando luego a pardo-canela. Pedicelos 7–9 × 3.5–5 mm. Sépalos 2.2–2.5 cm largo, angostamente obovados, coriáceos, verdes a verde-canela. Corola y frutos desconocidos.

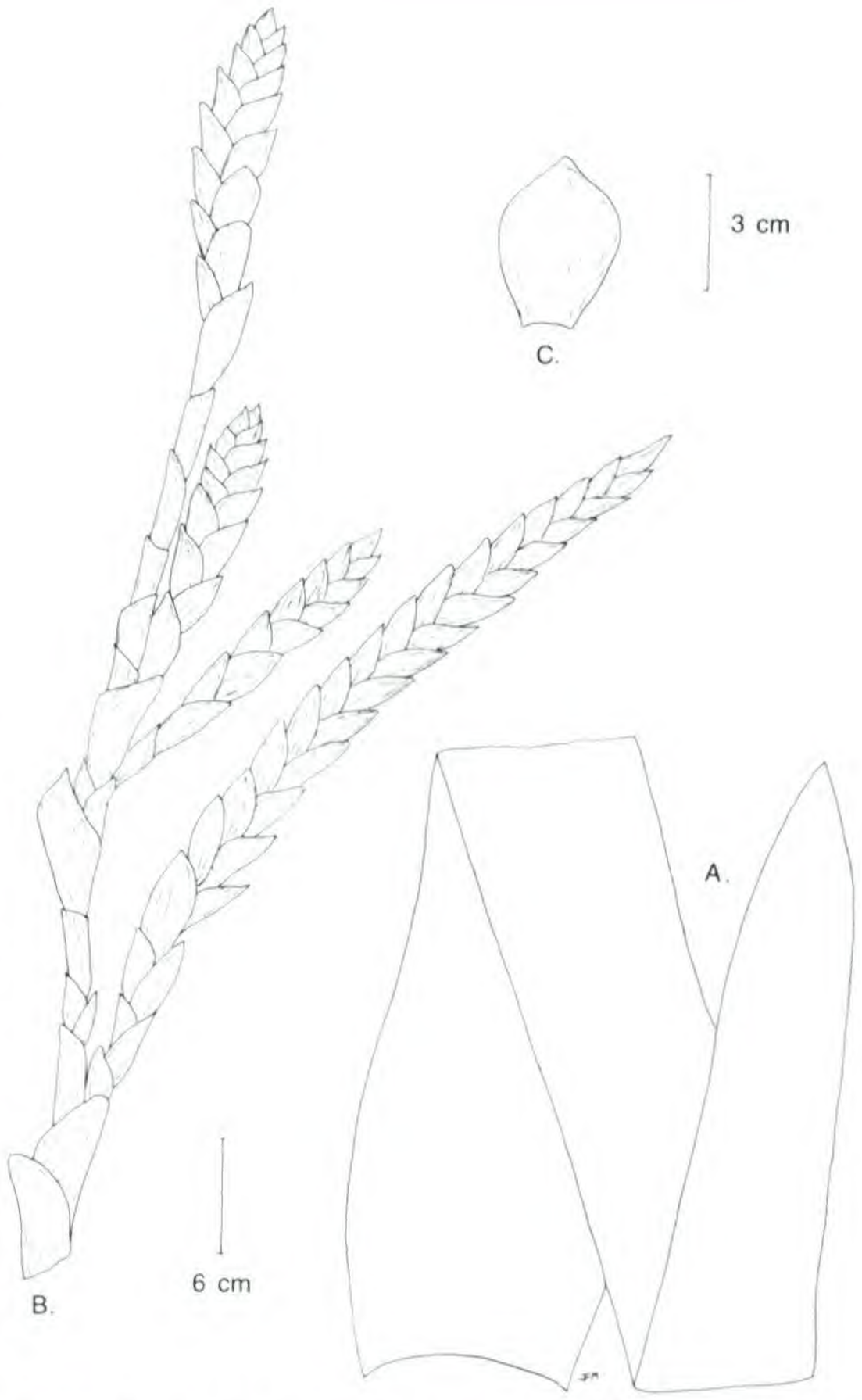

Figura 4. A–C. *Vriesea simulans* J. F. Morales (*Morales & Lépiz 2704*, INB). —A. Hoja. —B. Inflorescencia. —C. Sépalos.

Distribución. Costa Rica, conocida solamente en la Reserva Forestal de San Ramón y en sectores aledaños, en la vertiente atlántica de la Cordillera de Tilarán, entre 800 y 1000 m.

Fenología. Florece de abril a julio.

Vriesea simulans se encuentra cercanamente relacionada con *V. kupperiana* Suessenguth y *V. werckleana* Mez; sin embargo, se distingue de ambas por sus brácteas florales más largas, pardo-canela, en lugar de crema-canela, conspicuamente imbricadas, antes y despúes de la antésis, ramas laterales arqueados y algo pendulosos y por sus brácteas y flores dísticas.

Parátipos. COSTA RICA. **Alajuela:** carretera San Ramón–Bajo Rodríguez, *Luther et al. 2801* (INB, SEL).

Vriesea tiquirensis J. F. Morales, sp. nov. TIPO: Costa Rica. San José: Cantón de Acosta, Valle del Candelaria, Hacienda Tiquires, cuenca alta del Río Tiquires, 1200 m, 22 abr. 1995, *Morales et al. 3984* (holótipo, INB; isótipo, SEL).

A *Vriesea tonduziana* L. B. Smith, cui affinis, bracteis florigeris membranaceis fragilis differt.

Epífitas o terrestres; plantas en floración hasta 65 cm alto. Hojas rosuladas, extendidas, (29–)34–76 cm largo, punteado-lepidotas, especialmente en la cara abaxial, cartáceas, verdes a moradas abaxialmente. Vainas de las hojas anchamente elípticas, 16–19 × 5.8–9 cm, canela a canela-marrón, densamente punteado-lepidotas. Láminas de las hojas liguladas, 3.5–5(–6.2) cm ancho, acuminadas. Escapo erecto a erecto y algo arqueado, 30–47 cm × 7–9 mm, verde-canela a marrón claro. Brácteas del escapo erectas, 6–7 cm largo, más largas que los entrenudos, densamente imbricadas, verde-canela a canela-marrón. Inflorescencia simple, erecta a ligeramente erecto-arqueada, 19–30 × 3–4 cm, flores y brácteas florales dispuestas unilateralmente, con 8–15 flores. Brácteas primarias como las brácteas del escapo, más largas que los entrenudos. Brácteas florales 3.9–5.5 cm largo, anchamente ovadas, agudas a redondeadas, imbricadas, delicadamente membranáceas, ecarinadas, conspicuamente rugosas, canela-marrón, desintegrandose rápidamente despúes de la antésis y no persistentes en fructificación. Pedicelos 6–9 × 4 mm. Sépalos 2.5–4.1 cm largo, angostamente oblongo-obovados, cartáceos, verdes a verde-canela. Pétalos verde-blanco a verde-crema. Frutos desconocidos.

Distribución. Costa Rica en bosques muy húmedos y áreas alteradas de la Fila Aguabuena (Tiquires) y la Fila San Jerónimo, en el Valle del Río Candelaria en el cantón de Acosta, provincia de San José, 900–1300 m.

Fenología. Florece de abril a mayo.

Esta especie se encuentra cercanamente relacionada con *Vriesea tonduziana* L. B. Smith, pero se distingue por sus brácteas florales membranáceas y frágiles, descomponiendose rápidamente despúes de la antésis, no persistentes en fructificación.

Parátipos. COSTA RICA. **San José:** Cantón de Acosta, Fila Bustamante, cabeceras Quebrada San Jerónimo, *Morales 4462* (INB).

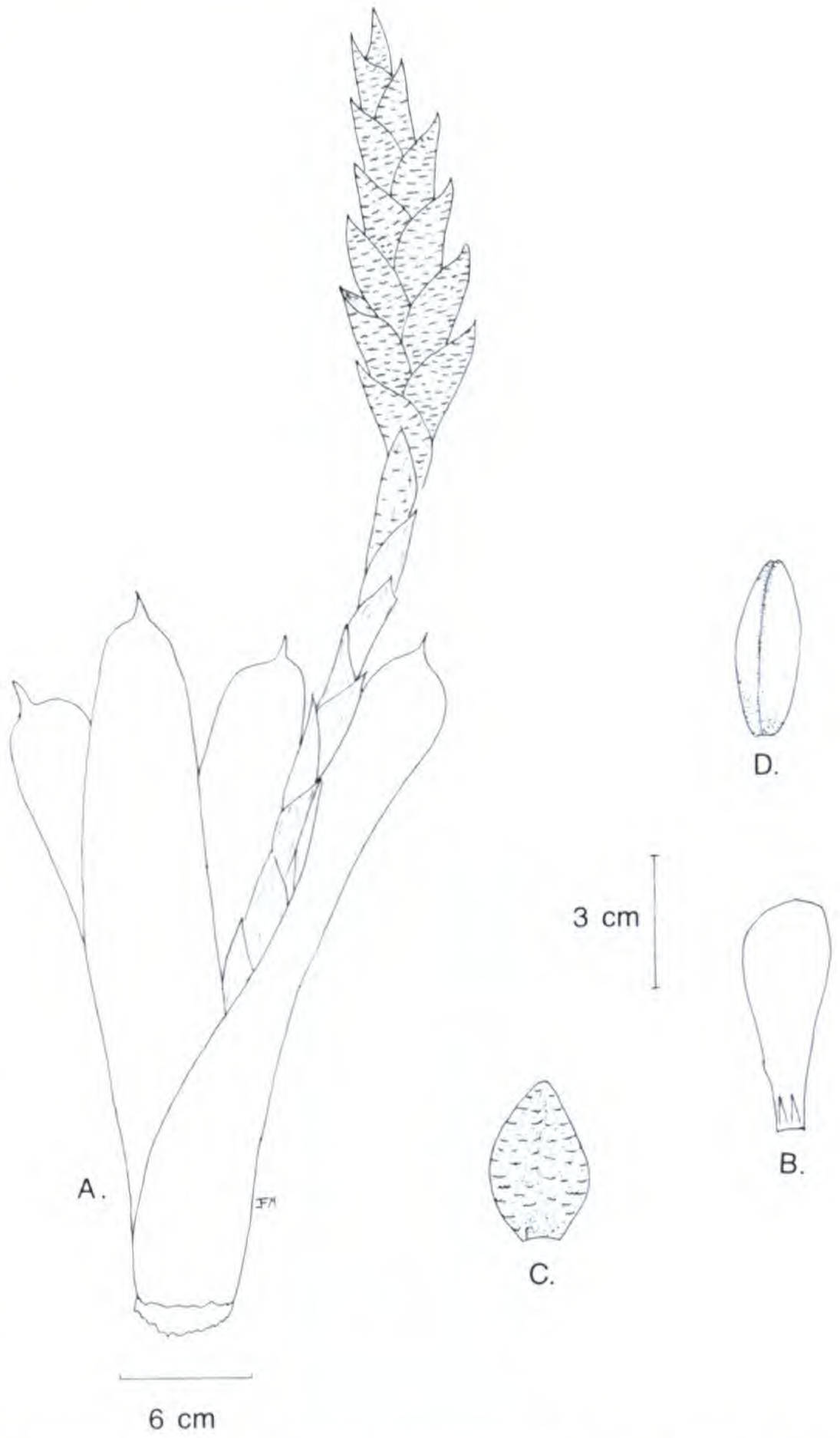

Figura 5. A–D. *Vriesea vulcanicola* J. F. Morales (*Morales et al. 2237*, INB). —A. Hábito. —B. Pétalo mostrando las escamas basales. —C. Sépalos. —D. Frutos.

Vriesea vulcanicola J. F. Morales, sp. nov. TIPO: Costa Rica. Guanacaste: Parque Nacional Rincón de La Vieja, Volcán Rincón de la Vieja, bosque enano en la falda SW, 9 ene. 1994, *Morales et al. 2237* (holótipo, INB; isótipo, MO). Figura 5.

A *Vriesea brunei* Mez & Wercklé, cui affinis, bracteis et sepalis rugosis differt.

Terrestres; plantas en floración hasta 45 cm alto. Hojas rosuladas, moderadamente extendidas, 27–34 cm largo, densamente a moderadamente punteado-lepidotas, cartáceas, verdes a moradas abaxialmente. Vainas de las hojas anchamente elípticas, 9–11 × 9–10 cm, canela a canela-marrón, densamente punteado-lepidotas. Láminas de las hojas liguladas, 5–6 cm ancho, subredondeadas y apiculadas. Escapo erecto, 33–37 cm × 7–9 mm, canela a verde-canela. Brácteas del escapo erectas, 5.5–6.5 cm largo, más largas que los entrenudos, den-

samente imbricadas, canela a verde-canela, conspicuamente y densamente rugosas. Inflorescencia simple, erecta, 18–22 × 4.5–6 cm, dística (aún en fructificación), con 10–13 flores. Brácteas primarias como las brácteas del escapo, más largas que los entrenudos. Brácteas florales 5.2–5.9 cm largo, anchamente ovadas, agudas y conspicuamente apiculadas, imbricadas y coriáceas, ecarinadas, densamente rugosas, verde-marrón a verde-rojizo en la antésis, canela-marrón con la edad. Flores dísticas (raramente muy ligeramente unilaterales). Pedicelos 2–4 × 4–5 mm. Sépalos 3–3.4 cm largo, anchamente ovados a oblongo-obovados, coriáceos, canela-marrón. Pétalos crema, 5.5–6 cm largo, angostamente obovados, obtusos, con dos escamas basales. Frutos cápsulas cilíndricas, 3.8–4.1 cm; semillas desconocidas.

Distribución. Costa Rica, donde es conocida solamente en los bosques enanos y ventosos de la cima del Volcán Rincón de la Vieja, Cordillera de Guanacaste, entre 1700 y 1800 m.

Fenología. Se encuentra en floración entre diciembre y febrero; fructifica de marzo a agosto.

Vriesea vulcanicola se encuentra cercanamente relacionada con *V. brunei* Mez & Wercklé, de la que se diferencia por sus brácteas y sépalos conspicuamente rugosos. Este carácter puede ser considerado poco consistente dentro del género; sin embargo, intensivos estudios de campo en poblaciones de *V. brunei* en la localidad tipo (Aguabuena, Valle del Candelaria) me han demostrado que esta especie siempre tiene las brácteas de la inflorescencia y escapo lisas, así como en otros sitios aparte de la localidad tipo (estribaciones de la Cordillera de Talamanca).

Además se puede confundir con *V. tonduziana* L. B. Smith, pero *V. vulcanicola* se reconoce fácilmente por su inflorescencia dística (no unilateral) y las brácteas florales engrosadas en un conspicuo apículo.

Parátipos. COSTA RICA. **Guanacaste:** Parque Nacional Rincón de la Vieja, Sector Las Pailas, Volcán Rincón de la Vieja, 15 ago. 1996, *Morales 5704* (INB, MO, SEL).

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A New Species of *Villarsia* (Menyanthaceae) from South Africa

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ABSTRACT. A second African species of *Villarsia*, *V. goldblattiana*, is described from South Africa. The genus otherwise is Australian (13 species) and southeastern Asian (1 species). *Villarsia goldblattiana* differs from *V. capensis* in its larger ovule number, glabrous seeds, longer calyx lobes, taller inflorescences, and apparent requirement of fire to induce flowering. It is known only from the southern Cape Peninsula. Both South African *Villarsia* species are tetraploid with $2n = 36$. An emended description of *V. capensis* is given, and the origin and location of its holotype and of the holotypes of the synonyms *Menyanthes ovata* L. f. and *M. capensis* Thunberg are discussed.

The only species of *Villarsia* (Menyanthaceae) currently recognized in Africa is *V. capensis* (Houttuyn) Merrill of Western Cape Province (Marais & Verdoorn, 1963; Dyer, 1975). Elsewhere, there are 13 species of the genus in Australia (Aston, 1969; Ornduff, 1990) and an additional one in southeastern Asia (Ornduff, 1994). As traditionally circumscribed, *Villarsia capensis* exhibits interpopulation variability in habitat, leaf size, and floral characters. I have suggested that further study of the South African plants may result in the recognition of more than one species (Ornduff, 1974). Recently, I examined specimens of South African *Villarsia* borrowed from BOL and NBG and concluded that a second species of *Villarsia* occurs in South Africa. I am naming it *Villarsia goldblattiana* in recognition of Peter Goldblatt's significant contributions to southern African botany, particularly the systematics and reproductive biology of the Iridaceae, and in appreciation for his considerable assistance in my study of *Villarsia* in South Africa.

Villarsia goldblattiana Ornduff, sp. nov. TYPE: South Africa. Western Cape Province: growing abundantly in shallow standing water of marsh, N of road to Olifantsbos, 1.7 mi. W of its junction with main road to Cape Point Nature Reserve, 5 Feb. 1971, *Ornduff 7099* (holotype, sheet I, NBG; isotype, sheet II, NBG). Figure 1.

Villarsiae capensi affinis sed differt in characteribus pluribus: inflorescentia 45–84 cm elata, 1.8-vel 2.5-plo longior quam folium longissimum; calycis lobi 6–14 mm longi, 2–3 mm late basi; ovaria ovulis 3–8; semina glabra.

Erect, tufted, non-stoloniferous perennial. Basal leaves erect, evergreen, with petioles 12–32 cm long; blades fleshy, oblong to ovate, 4–9 cm long, 1.5–8 cm wide, attenuate to cordate at base, entire. Inflorescence an open panicle with 16–55 flowers, 45–85 cm tall, the tallest 1.8–2.5 times the length of the longest leaves, with cauline leaves gradually reduced upward to scales. Flowers distylous, open for only one day, on pedicels 1–2 cm long. Corolla yellow, the 5 obovate lobes about twice the length of the calyx lobes, the margins fimbriate, with hairs on parts of the upper surface. Calyx lobes 5, ± lanceolate, 6–14 mm long, 2–3 mm wide at the base. Ovules 3–8 per ovary. Capsules ovoid, equaling or slightly longer than the calyx lobes. Seeds glabrous, yellow, ± orbicular, biconvex, 1.5–2 mm diam. Wet soil and marshes, Cape Peninsula. Near sea level to 600 m. Flowers October to January, reportedly after fire.

Paratypes. SOUTH AFRICA. **Western Cape Province:** "... in summo monte 'Steenberg' alt. circa 800 ped.," Dec. 1903, *L. Kensit s.n.* (BOL); Muizenberg Plateau, Nov. 1913, *E. Kensit s.n.* (BOL); Noord Hoek Mts., alt. 2000 ft., 2 Jan. 1945, *Compton 16898* (BOL, NBG); Cape Point, Patrys Vlei, 24 Nov. 1946, *Compton 18826* (NBG); Smitswinkel Flats, Cape Peninsula, 29 Oct. 1942, *Compton 14007* (NBG).

Villarsia goldblattiana has 3–8 ovules per ovary, glabrous seeds, calyx lobes that are 6–14 mm long, and inflorescences that are 45–85 cm tall and 1.8–2.5 times the length of the longest leaves. It grows from near sea level to 600 m in elevation and is known only from the southern Cape Peninsula, where it has been collected on the slopes above Noordhoek and the Steenberg plateau south to the Smitswinkel Flats in the Cape Point Nature Reserve. It is reported to flower after a fire (Fraser & McMahon, 1994; P. Salter, pers. comm. 1997). I suspect that the primary effect of fire is to increase light intensity by temporarily reducing the shading that is caused by an overstory of fynbos shrubs. I revisited the type locality of this species in early September 1998, but was unable to find any plants

Figure 1. Holotype of *Villarsia goldblattiana*. The scale is 5 cm.

at the site. *Villarsia capensis* has 1–2 ovules per ovary, (usually) papillate seeds (illustrated in Chuang & Ornduff, 1992), calyx lobes that are 4–6 mm long, and inflorescences that are 12–45 cm tall and 0.9–2.1 times the length of the longest leaves. It grows from 200 to 1520 m in elevation and ranges from the Humansdorp region to the mountains east of Paarl and Stellenbosch and westward from there to the Cold Bokkeveld. It is also common on Table Mountain. It does not require fire to flower. It and *V. goldblattiana* are tetraploid with $n = 18$ (Ornduff, 1974). A photograph of *V. capensis* can be found in Burman and Bean (1985), and a painting of *V. goldblattiana* has been published by Fraser and McMahon (1994, as *V. capensis*).

An emended description of *V. capensis* follows:

Villarsia capensis (Houttuyn) Merrill

Erect, tufted, non-stoloniferous perennial. Basal leaves erect, evergreen, with petioles 2–25 cm long; blades fleshy, oblong to ovate, 1–9 cm long, 0.6–6.5 cm wide, rounded to cordate at base, usually with widely spaced shallow teeth or sometimes entire. Inflorescence a congested to open panicle with 5–75 flowers, 12–45 cm tall, the tallest 0.9–2.1 times the length of the longest leaves, with cauline leaves gradually reduced upward to scales. Flowers distylous, open for only one day, on pedicels 0.2–2.5 cm long. Corolla yellow, the 5 linear to narrowly obovate lobes about twice the length of the calyx lobes, the margins fimbriate, usually hairy on parts of the upper surface. Calyx lobes 5, ± lanceolate, 4–6 mm long, 1.5–2.5 mm wide at the base. Ovules 1–2 per ovary. Capsules ovoid, equaling or slightly longer than the calyx lobes. Seeds usually papillate, yellow or brown, ± orbicular, biconvex, 1.5–2 mm diam. Wet soil, marshes, and stream margins, 200–1520 m. Flowers September to January.

The epithet "*capensis*" traces back to *Renealmia capensis* Houttuyn (1777). Houttuyn's work was discussed extensively by Merrill (1938), who wrote (p. 310), "All attempts to locate a Houttuyn herbarium have failed, and the probability is that most of his actual types are no longer extant." Marais and Verdoorn (1963) thus considered Houttuyn's illustration to be the type, but the floral details in that illustration are crude and inaccurate. In 1998, G. Thijsse (L) wrote me, "According to an unpublished mss. the main set of Houttuyn's herbarium is at Geneva. Also the holotype of *Renealmia capensis* is at G." The types of *Menyanthes ovata* L. f. (1782, not 1781 fide Manitz, 1976) and *M. capensis* Thunberg (1794) both are Thunberg collections. Photographs of these types and of the holotype of *R. capensis* in the Burman herbarium at G indicate that these three specimens are almost certainly duplicates of the same collection, and an additional Thunberg specimen in the Vahl Herbarium at C very likely is also from the same collection. Thunberg (1823) stated that *M. capensis* "crescit in Krum-rivier [= Krom River] et in summo Taffelberg." His specimens, however, are clearly not from Table Mountain (Taffelberg), since Table Mountain plants are uniformly smaller, and have elliptic or oblong rather than ovate leaves. The Thunberg specimens are larger, with inflorescences to 35 cm tall; these are 1.5–1.7 times the length of the longest leaves, which are ovate. They resemble plants collected at Kirby (*Fourcade 5901*, BOL), "Ralets" (= Ratels) Bosch flats (*Fourcade 396*, BOL), and Wagenbooms River, Long Kloof (*H. Bolus 2404*, BOL), all at the eastern end of the range of *V. capensis* (Fourcade, 1940). Krom River originates at the eastern end of the Tsitsikamma Mountains and empties into St. Francis Bay in the general region of the three collections cited above. Thunberg visited this area between September 1772 and early January 1773 and again between September 1773

and January 1774 (Karsten, 1939). The distribution of this larger form (to which the holotype of *V. capensis* belongs) is disjunct. It has been collected at the eastern end of the range of the species, but also in the Ceres area (*Guthrie 2191*, NBG, and *Compton 10090*, NBG, the latter with the comment that it "looks very different from the Table Mountain swamp-plant!") and the Badsberg (*Walters 1557*, BOL). The smaller, more widespread form also has been collected near the last locality in Bain's Kloof (*Schlechter 9174*, BOL; *Leighton 2153*, BOL; *Ornduff 7267*, UC). No taxonomic separation of these two forms is suggested at present.

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A New Species of *Ceratozamia* (Zamiaceae, Cycadales) from Chiapas, Mexico

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ABSTRACT. A new species of cycad, *Ceratozamia alvarezii* (Zamiaceae) from Chiapas, is described and illustrated. This species has affinities with *C. matudai* from Chiapas and *C. sabatoi* from Queretaro and Hidalgo. It differs from these species with regard to trunk, leaf habit, and male and female cones. It differs from *C. norstogii*, also from Chiapas, in that the latter is a much larger unbranched plant with a spirally twisting leaf rachis.

RESUMEN. Se describe e ilustra una nueva especie, *Ceratozamia alvarezii* (Zamiaceae). Esta especie presenta afinidad con *C. matudai* y *C. sabatoi* de Queretaro e Hidalgo. Esta especie difiere de las anteriores por la hoja, hábito de los estróbilos y morfología del tronco. También difiere de *C. norstogii* dado que la última es una planta más grande, no ramificada y la ráquis torcida espiralmente.

During the course of botanical explorations in one of the natural areas of Chiapas that has recently been decreed as a Biosphere Reserve, we collected a species of *Ceratozamia* with a unique combination of trunk, leaf, and cone characters.

We believe that the new species is close to *Ceratozamia matudai* Lundell. Specimens of the new plant and *C. matudai* were cultivated under the same conditions for comparison purposes for a period of two years, in which time new leaf flushes and cones occurred. The plants under cultivation continued to present the same characteristics as those of the natural habitat. The cones of *Ceratozamia alvarezii* differed from those of *C. matudai* as well as those of *C. norstogii* Stevenson, which also is from Chiapas; *C. norstogii* also differs in its much larger habit, and in having an erect nonbranching trunk and leaves with a spirally twisted rachis.

Ceratozamia alvarezii Perez-Farrera, Vovides & Iglesias, sp. nov. TYPE: Mexico. Chiapas: Sierra Madre of Chiapas, 4 Mar. 1996, *M. A. Perez-Farrera 889* ♂ (holotype, CHIP; isotypes, F, MEXU, MO). Figure 1.

Planta trunco subgloboso ad cylindricum semihypogaeo ad hypogaeum, ramoso, 10–50 cm alto; cataphyllis lanatis triangularibus, stipulatis. Folia pinnata; petiolo 14–42 cm longo; rhachidi 25–66 cm longa; foliolis oppositis ad subopposita, 24–62-jugis, lineari-lanceolatis. Strobilus masculinus lineari-cylindricus 11–31 cm longus pedunculo tomentoso 4–5 cm longo insidens; strobilus femininеus 14.5–19 cm longus pedunculo tomentoso 4.5–6.5 cm longo insidens; seminibus 1.7–2.5 cm longis.

Trunk subglobose, 10–50 cm long, partially subterranean, becoming cylindrical with age, branching freely, 8.9–17.5 cm diam. and protected by persistent petiole bases. Cataphylls stipulate, lanulose, 2.1–5 cm long, 1.5–3 cm wide, brown. Leaves 4–18, pinnate, spirally arranged forming an open crown, 54–109 cm long, 31.5–61 cm wide. Petiole 14–42 cm long, rachis 25–66 cm long, both ascending, tomentose, especially at the base, armed with short stout prickles 2–5 mm, which decrease toward the apical part of the rachis, occasionally mildly twisted. Leaflets 24–62, linear-lanceolate, opposite to subopposite, flat, coriaceous, margins entire, pubescent when immature, glabrous with age, adaxial surface dark green, abaxial surface light green, 16–32.5 cm long, 4–9 mm wide, venation visible on the abaxial surface, number of veins 5–9, distance between veins 0.05–1 mm. Microstrobilus cylindrical to conical, light green to olive green upon emergence, light yellow to creamy yellow when mature, 11–31 cm long, 2.5–4.5 cm diam., peduncle tomentose, 4–5 cm long, 1–1.8 cm diam. Microsporophylls numerous, inserted spirally with vertical rows, cuneiform, 1.4–1.7 cm long,

0.6–0.9 cm wide, bicornate in the distal part, with the fertile portion covering ½–⅔ of the abaxial surface excluding the horns. Microsporangia numerous in sori of 3–4, longitudinally dehiscent. Megastrobilus cylindrical to barrel-shaped, olive green upon emergence, brown ochre when mature, 14.5–19 cm long, 5.7–10.5 cm diam., peduncle tomentose, 4.5–6.5 cm long, 1.8–2.2 cm diam. Megasporophylls numerous, peltate, inserted spirally on the cone axis forming apparent vertical rows, 2.8–4.5 cm long, 1.5–2.9 cm wide, distal end hexagonal, bicornate, with brown ochre tomentum on the lobulate part around the horns. Seed ovate, sarcotesta white when immature and creamy yellow when mature, sclerotesta smooth and beige in color, 1.7–2.5 cm long, 1.7–2.0 cm diam. with 7–9 radial ridges. Chromosome number $2n = 16$.

Paratype. MEXICO. **Chiapas:** Sierra Madre de Chiapas, 2 Oct. 1996, *Perez-Farrera 1260* ♀ (XAL).

Other specimens examined. MEXICO. **Chiapas:** Sierra Madre de Chiapas, *Perez-Farrera 64, 67* (CHIP), *Castillo-Hernandez 624, 445* (CHIP), *Breedlove 70956, 60309* (CAS).

Ceratozamia alvarezii principally occurs in oak forest as described by Rzedowski (1978) at an altitude of 950 m. This forest has an overstory of *Quercus magnifolia* Nee, *Quercus elliptica* Nee, and *Pinus ooacarpa* Schiede above a shrubby layer dominated by *Calliandra houstoniana* (Mill) Standley and *Canavalia hirsuta* (Martens & Galeotti) Standley. The herbaceous layer consists mainly of *Anthurium cerrobaulense* Matuda, *Lisiacis procerrima* (Hackel) Hitchcock, *Elaphoglossum sartorii* (Liebmann) Mickel, *Polypodium furfuraceum* Schlechtendal & Chamisso, and *Polypodium santae-rosae* (Maxon) C. Christensen.

Discussion

The specific epithet was chosen to honor the late Miguel Alvarez del Toro, in recognition of his tireless pioneering efforts in conservation, which led to the establishment of the first biological reserves in the state of Chiapas.

Specific locality information for this species is being purposely omitted to avoid potential illegal collection and the possible decimation of its populations. We have only located two populations of this species in a single geographical area in the Sierra Madre de Chiapas. Even though leaf characteristics occasionally display morphological similarities between *Ceratozamia matudai* and *C. alvarezii* (both have flat linear and linear-lanceolate leaflets), the two species differ with respect to the growth habit and the female cones. The peduncle of the female cone of *C. alvarezii* is thick and erect, while that of *C. matudai* is long, thin, and decumbent. *Ceratozamia sabatoi* Vovides, Vázquez Torres, Schutzman & Iglesias (Vovides et al., 1993) differs from *C. alvarezii* by having wider, longer leaflets and blue-green to blue-brown megastrobili. *Ceratozamia norstogii* is a much larger plant with an unbranching trunk and a spirally twisted leaf rachis. The consistent differences in cone and vegetative habit led us to consider *C. alvarezii* as a separate species. The chromosome count for the new species ($2n = 16$) appears consistent with members of this genus investigated so far. We consider *C. alvarezii* to be endangered, since the oak forests in which it occurs are being transformed for agricultural expansion.

The following key separates *Ceratozamia alvarezii* from *C. matudai*, *C. sabatoi*, and *C. norstogii*.

Diagnostic Key

1a. Leaf rachis spirally twisted . . . . . *C. norstogii*
1b. Rachis not twisted.
  2a. Leaflet articulation yellow . . . . . *C. matudai*
  2b. Leaflet articulation green.
    3a. Leaflet lanceolate, narrowly obovate to subulate; leaflet veins 9 to 14 . . . . . *C. sabatoi*
    3b. Leaflet linear lanceolate; leaflet veins 5 to 9 . . . . . *C. alvarezii*

Due to the morphological characteristics that the new species presents, coriaceous linear-lanceolate leaflets with long-attenuate tips, we include it within the second group within *Ceratozamia* described by Stevenson et al. (1986), which includes *C. mexicana* Brongniart, *C. zarogozae* Medellin, *C. matudai*, *C. kuesteriana* Regel, *C. robusta* Miquel, *C. sabatoi*, and, in our opinion, *C. whitelockiana* Chemnick & Gregory.

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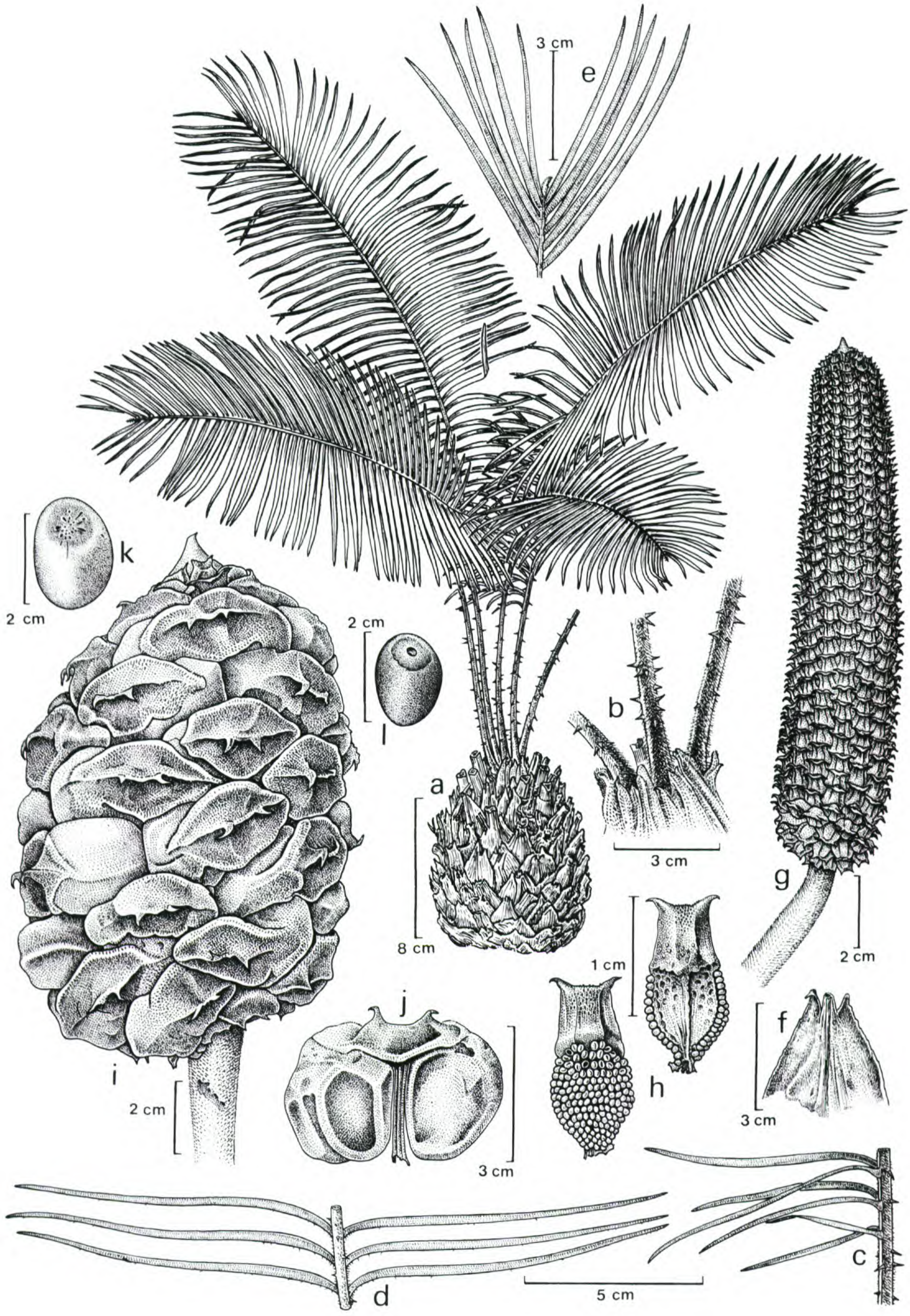
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financed exploration and monitoring studies of the cycads of the Sierra Madre de Chiapas. The second author acknowledges CONACYT project No. 1837P-N9507 for travel to Chiapas and participation in some of the explorations. The authors also thank Edmundo Saavedra for the excellent botanical illustrations and the reviewers of *Novon*, G. J. Breckon and D. W. Stevenson, for useful comments and suggestions for improving the manuscript.

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Figure 1. *Ceratozamia alvarezii* Perez-Farrera, Vovides & Iglesias. —a. Adult plant. —b. Detail of petioles. —c–e. Leaf details. —f. Cataphyll. —g. Microstrobilus. —h. Detail of microsporophyll and microsporangia. —i. Megastrobilus. —j. Megasporophyll. —k. Seed. —l. Seed with sclerotesta removed. Based on living collection (from type locality) at Clavijero Botanic Garden, Xalapa; accession number 96-012.01. Female cone, *Perez Farrera 1260* (XAL); male cone, *Perez-Farrera s.n.* (XAL).

Wimmerella, a New South African Genus of Lobelioideae (Campanulaceae)

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ABSTRACT. The 10 South African species currently assigned to *Laurentia* (an otherwise Mediterranean genus) are segregated here as the genus *Wimmerella* on the basis of their basal (vs. medial) bracteoles; larger flowers and fruits; and subglobose (vs. ellipsoid) seeds lacking a strophiole, which are sulcate with flattened (vs. keeled) walls.

Laurentia Adanson, as circumscribed by Wimmer (1953, 1968), was a genus of oddly discontinuous distribution. Its 27 species were restricted to either the Mediterranean region (3 spp.), South Africa (10 spp.), Australia (10 spp.), western North America (3 spp.), or the West Indies (1 sp., spread in historic times throughout much of the tropics). Phytogeographic coherence of the infrageneric taxa recognized in Wimmer's treatment was no better. The Mediterranean and South African species and two of the species from North America were assigned to section *Laurentia*; the remaining North American endemic to section *Palmerella* (A. Gray) E. Wimmer; and the Australian and West Indian species to section *Isotoma* (R. Brown) Endlicher.

However, this very broadly construed *Laurentia* was something of an innovation with Wimmer. Many of the species had been assigned to smaller genera by earlier authors, and that is the classification preferred by most current workers (e.g., McVaugh, 1940a, 1943; Mason, 1957; Melville, 1960; McComb, 1970; Elliot & Jones, 1990; Chapman, 1991; Skog, 1991; Lammers, 1993; Morin, 1993; Kartesz, 1994). Here, the Australian species comprise *Isotoma* (R. Brown) Lindley, the sole West Indian species is segregated as *Hippobroma* G. Don, and the North American species are assigned to *Porterella* Torrey and *Palmerella* A. Gray. As noted by Lammers (1997), this leaves only the Mediterranean and South African species in *Laurentia*. The present paper executes the final dismemberment of *Laurentia*, by segregating the species of these two regions into separate genera.

Evidence supporting the generic distinctness of the Mediterranean and South African species was provided in detail by Serra and Crespo (1997) and Crespo et al. (1998). These authors placed particular emphasis on differences in seed morphology: seeds of the South African species are subglobose, lack a strophiole, and are sulcate with flattened walls; those of the Mediterranean species are ellipsoid, strophiolate, and sulcate with keeled walls. The extreme value of seed features in Lobelioideae was first stressed by McVaugh (1936, 1940b) and recently expanded upon by Murata (1992, 1995). The two groups of species were also distinguished by bracteole position (basal in South Africa, medial in the Mediterranean) and by the larger flowers and fruits of the former. Furthermore, in the Mediterranean species, the plants are erect and the flowers solitary in an axillary position (appearing terminal in rosulate species). In contrast, the South African species have decumbent stems with solitary axillary flowers; or if the stems are erect, then the flowers are borne in a 2–15-flowered terminal raceme. As these differences are consonant with differences used to distinguish genera in the subfamily, Serra and Crespo (1997) and Crespo et al. (1998) recognized the Mediterranean and South African species as two distinct genera.

But what names should these genera bear? Meikle (1979) published a brief note contending that the name *Laurentia* was a superfluous renaming of *Lobelia*. In its place, he adopted the name *Solenopsis* C. Presl. Recently, however, Lammers (1997) presented evidence that *Laurentia* was not illegitimate, and formally proposed that the name be conserved to ensure stability. The type of *Laurentia* is

Lobelia laurentia L. [≡ *Solenopsis laurentia* (L.) C. Presl, = *Laurentia gasparrinii* (Tineo) Strobl], while the lectotype of *Solenopsis* (designated by Pfeiffer, 1874: 1192) is *Lobelia minuta* L. [≡ *Solenopsis minuta* (L.) C. Presl, ≡ *Laurentia minuta* (L.) A. DC.]. Both species belong to the Mediterranean genus, which will thus be called either *Laurentia* or *Solenopsis*, depending on the outcome of Lammers's (1997) proposal.

For the South African genus, Serra and Crespo (1997) and Crespo et al. (1998) took up the name *Enchysia* C. Presl, which had been cited as a synonym of *Laurentia* by Wimmer (1953). When published by Presl (1836: 40), *Enchysia* included six species. One of these, *E. scapigera* (R. Brown) C. Presl, is now treated (Elliot & Jones, 1990; Chapman, 1991) as a member of the Australian genus *Isotoma* [i.e., *I. scapigera* (R. Brown) G. Don], while three others (*E. baueri* C. Presl, *E. gaudichaudii* C. Presl, and *E. lessonii* C. Presl) are all synonyms of the related *I. fluviatilis* (R. Brown) F. Mueller ex Bentham (McComb, 1970). The last two of the six original species were from South Africa, but are not referable to *Laurentia* sensu Wimmer (1953, 1968). *Enchysia repens* (Thunberg) C. Presl (based on *Lobelia repens* Thunberg) is a synonym of *Lobelia anceps* L. f. (Thulin, 1983), while *Enchysia erinoides* (L.) C. Presl (based on *Lobelia erinoides* L.) is a synonym of *Lobelia erinus* L. (Thulin et al., 1986). Because it was this last species, *L. erinoides*, that was designated as the lectotype of *Enchysia* by Pfeiffer (1874: 1199), that generic name is properly a synonym of *Lobelia* L. and cannot be used for the South African species formerly assigned to *Laurentia*. Even if Pfeiffer's choice were to be overturned, there is no way to lectotypify this name that would permit its use for South African *Laurentia*; if it is not a synonym of *Lobelia*, it will be a synonym of *Isotoma*.

A thorough survey of all generic names referable to Lobelioideae shows that none can be typified on the basis of one of the South African species of *Laurentia*. Therefore, a new genus is erected to accommodate these species. The key below may be used to distinguish the new genus from its allies.

KEY TO THE GENERA INCLUDED IN *LAURENTIA* S.L.

1a. Corolla scarcely zygomorphic; filament tube fully adnate to the corolla.
  2a. Calyx lobes 2–10 mm long; corolla 8–30 mm long; filament tube 3–20 mm long; anther tube black, the ventral two setose at apex (Australia) . . . . . *Isotoma*
  2b. Calyx lobes 10–22 mm long; corolla 60–150 mm long; filament tube 55–145 mm long; anther tube white, all five setose at apex (pantropical weed, originally endemic to West Indies) . . . . . *Hippobroma*
1b. Corolla distinctly bilabiate, the dorsal lip 2-lobed, the ventral 3-lobed; filament tube free from corolla, or only the two dorsal filaments adnate.
  3a. Corolla 20–30 mm long; filament tube 9.5–17 mm long, the two dorsal filaments adnate to the corolla (western North America) . . . . . *Palmerella*
  3b. Corolla 3–20 mm long; filament tube 1.5–7 mm long, free from corolla.
    4a. Stems fleshy; calyx lobes 3–8(–11) mm long; capsules 5–10(–16) mm long; seeds ca. 1 mm long (western North America) . . . . . *Porterella*
    4b. Stems herbaceous; calyx lobes 1–4 mm long; capsules 1–6 mm long; seeds 0.3–0.5 mm long.
      5a. Stems erect, the flowers solitary and axillary or terminal; pedicels with 1–3 bracteoles near the middle; filament tube 1.5–2.5 mm long; capsules 1–3 mm long; seeds ellipsoid, strophiolate, sulcate with keeled walls (Mediterranean region) . . . . . *Solenopsis* (= *Laurentia*, nom. cons. prop.)
      5b. Stems decumbent, the flowers solitary and axillary, or if erect, the flowers 2–15 in a terminal raceme; pedicels bibracteolate at base; filaments 2–6 mm long; capsules 2.5–6 mm long; seeds subglobose, lacking a strophiole, sulcate with flattened walls (South Africa) . . . . . *Wimmerella*

Wimmerella L. Serra, M. B. Crespo & Lammers, gen. nov. TYPE: *Wimmerella secunda* (L. f.) L. Serra, M. B. Crespo & Lammers.

A *Solenopsis* (= *Laurentia* s. str.) bracteolis basalibus, floribus capsulisque majoribus, atque seminibus subglobosis strophiolo destitutis testa sulcata cum parietibus applanatis differt.

Annual or perennial plants up to 30(–40) cm high. Stems decumbent or erect, simple or branched, glabrous or pubescent. Leaves cauline, alternate, in some species only rosulate, sessile or petiolate; lamina orbicular to linear, entire or with 5–9 teeth or lobes, 3–40 mm long, 2–12 mm wide. Flowers solitary in leaf axils or (in plants with erect stems) 2–15 in terminal racemes up to 25 cm long; bracts linear to lanceolate, 5–30 mm long, 1–3 mm wide; pedicels (2–)5–20 mm long in fruit. Calyx lobes oblong, lanceolate or linear-lanceolate, entire, 1–3 mm long, glabrous or pubescent. Corolla white or blue (sometimes with a white patch in the throat), 3–18 mm long, bilabiate with 2 linear dorsal lobes and 3 oblong ventral lobes or nearly regular with 5 subequal linear-oblong lobes, glabrous; tube funnel-shaped or tubular. Staminal column free from

the corolla; filaments 2–6 mm long; anther tube 0.8–1 mm long, light black, glabrous or short pubescent distally, bisetose at the apex of the ventral pair. Ovary inferior, bilocular; placentation axile. Capsule apically dehiscing via two valves, 2.5–6 mm long, the calyx persistent. Seeds subglobose, lacking a strophiole, light brown, smooth and lustrous, 0.4–0.5 mm long, sulcate with flattened walls.

Wimmerella is endemic to South Africa. Populations occupy diverse habitats from the coastal regions to the central plateaus, at elevations from sea level up to 1800 m. After study of over 100 specimens (see Acknowledgments for herbaria), it was decided to follow the treatment of Wimmer (1953, 1968) and Welman (1993), in which 10 species are recognized. All are confined to the Cape Province with the exception of *W. arabidea*, which also occurs in Natal (Welman, 1993).

The names of two species originally described by Wimmer (1968) and recognized by Welman (1993) were not validly published. Wimmer failed to designate a type as defined by Article 8.1 of the *Code* (Greuter et al., 1994), an oversight perhaps attributable to the fact that his manuscript was not published until seven years after his death. Two duplicates of one gathering were cited for each name without singling one out as the holotype, thus violating Article 37.3. These two species are here named by designating a holotype and providing an explicit reference to Wimmer's (1968) effectively published Latin diagnosis, as allowed by Article 32.4. [See note added in proof.]

Etymology. The genus is named for Franz Elfried Wimmer (1881–1961), the Austrian botanist and Roman Catholic priest who was the foremost twentieth century student of the Lobelioideae (Rechinger, 1961). The honorific is rendered as a diminuitive to avoid homonymy with *Wimmeria* Schlechtendal (Celastraceae) and to parallel the related genera *Palmerella* and *Porterella*.

KEY TO THE SPECIES OF *WIMMERELLA*

1a. Leaves suborbicular or cordate-reniform.
2a. Stems erect or decumbent, glabrous; pedicels 2–7 mm long; corolla 3 mm long . . . . . *W. frontidentata*
2b. Stems decumbent or prostrate, pubescent; pedicels 8–18 mm long; corolla 3–8 mm long.
3a. Leaves very sparsely pubescent with trichomes ca. 0.4 mm long, the margin 5–9-toothed (rarely subentire) . . . . . *W. pygmaea*
3b. Leaves densely pubescent with trichomes ca. 0.2 mm long, the margin 5–9-lobed.
4a. Pedicels 8–11 mm long, pubescent throughout; corolla 3–4 mm long . . . . . *W. hederacea*
4b. Pedicels 12–18 mm long, glabrous or pubescent only at the base; corolla 6–8 mm long . . . . . *W. hedyotidea*
1b. Leaves lanceolate, linear-lanceolate, lanceolate-spatulate, or oblong-spatulate.
5a. Leaves pubescent (rarely glabrous); bracts oblong or linear, longer than the pedicel; corolla white, 4–7 mm long . . . . . *W. secunda*
5b. Leaves glabrous; bracts linear, up to half the length of the pedicel; corolla blue, sometimes with a white patch in the throat, 6–18 mm long.
6a. Corolla 18 mm long . . . . . *W. longitubus*
6b. Corolla 6–12 mm long.
7a. Leaves oblong-spatulate, incised-dentate; corolla 11–12 mm long . . . . . *W. giftbergensis*
7b. Leaves linear-lanceolate or lanceolate-spatulate, entire or denticulate; corolla 6–10 mm long.
8a. Leaves linear-lanceolate; corolla 6 mm long; capsule 2.5 mm long . . . . . *W. mariae*
8b. Leaves lanceolate-spatulate; corolla (6–)7–10 mm long; capsule 4 mm long.
9a. Leaves 5–10 mm long; inflorescence 2–5-flowered . . . . . *W. bifida*
9b. Leaves 10–30 mm long; inflorescence 5–15-flowered . . . . . *W. arabidea*

Wimmerella arabidea (C. Presl) L. Serra, M. B. Crespo & Lammers, comb. nov. Basionym: *Rapuntium arabideum* C. Presl, Prodr. Monogr. Lobel. 18. 1836. *Laurentia arabidea* (C. Presl) A. DC., in DC., Prodr. 7: 410. 1839. *Lobelia arabidea* (C. Presl) Steudel, Nomencl. Bot. (ed. 2) 2: 59. 1841. TYPE: South Africa. Cape Province: "Cap B. Sp. in parte inferiore occidentali," *Anonymous s.n.* (lectotype, designated by Wimmer (1968: 853), PR not seen).

Wimmerella bifida (Thunberg) L. Serra, M. B. Crespo & Lammers, comb. nov. Basionym: *Lobelia bifida* Thunberg, Prodr. Fl. Cap. 40. 1794. *Rapuntium bifidum* (Thunberg) C. Presl, Prodr. Monogr. Lobel. 30: 1836. *Laurentia bifida* (Thunberg) Sonder, in Harvey & Sonder, Fl. Cap. 3: 552. 1865. TYPE: South Africa. Cape Province: "Am Rande des Berges Bockland," *Thunberg s.n.* (lectotype, designated by Wimmer (1953: 394), UPS not seen).

Wimmerella frontidentata L. Serra, M. B. Crespo & Lammers, sp. nov. TYPE: South Africa. Cape Province: Swellendam Div., Anysberg, sheltered S side rocks, 1600 m, 21 May 1950, *Esterhuysen 17070* (holotype, PRE; isotype, BOL). [Validated by reference to the effectively published Latin description of "Laurentia frontidentata" E. Wimmer, Pflanzenr. IV.276c: 855. 1968, nom. invalid.]

Wimmerella giftbergensis (E. Phillips) L. Serra, M. B. Crespo & Lammers, comb. nov. Basionym: *Lobelia giftbergensis* E. Phillips, Ann. S. African Mus. 9: 121. 1913. *Laurentia giftbergensis* (E. Phillips) E. Wimmer, Repert. Spec. Nov. Regni Veg. 38: 77. 1935. TYPE: South Africa. Cape Province: Van Rhynsdorp Div., Giftberg Range, 1000–2000 ft., Sep. 1911, *Phillips 7599* (holotype, K).

Wimmerella hederacea (Sonder) L. Serra, M. B. Crespo & Lammers, comb. nov. Basionym: *Laurentia hederacea* Sonder, in Harvey & Sonder, Fl. Cap. 3: 553. 1865. TYPE: South Africa. Cape Province: "C. B. S., Hab. Eastern frontier," *Hutton s.n.* (holotype, K).

Wimmerella hedyotidea (Schlechter) L. Serra, M. B. Crespo & Lammers, comb. nov. Basionym: *Laurentia hedyotidea* Schlechter, Bot. Jahrb. Syst. 27: 197. 1899. TYPE: South Africa. Cape Province: in regioni austro-occidentali, in saxosis montium pone Bainskloof, in ditione Ceres, alt. ca. 4000 ped., 11 Nov. 1896, *Schlechter 9104* (lectotype, designated by Wimmer (1953: 396), B not seen; isolectotype, K).

Wimmerella longitubus (E. Wimmer) L. Serra, M. B. Crespo & Lammers, comb. nov. Basionym: *Laurentia longitubus* E. Wimmer, Repert. Spec. Nov. Regni Veg. 22: 193. 1926. TYPE: South Africa. Cape Province: Cape of Good Hope, in humidis Langebergen prope Riversdale, *Schlechter 1902* (holotype, WU not seen).

Wimmerella mariae L. Serra, M. B. Crespo & Lammers, sp. nov. TYPE: South Africa. Cape Province: Worcester Div., plateau between Matroosberg and Sonklip Peak, in dry mud on floor of small pans, ca. 1800 m, 17 Jan. 1959, *Esterhuysen 28132* (holotype, BOL; isotype, W not seen). [Validated by reference to the effectively published Latin description of "Laurentia mariae" E. Wimmer, Pflanzenr. IV.276c: 854. 1968, nom. invalid.]

Wimmerella pygmaea (Thunberg) L. Serra, M. B. Crespo & Lammers, comb. nov. Basionym: *Lobelia pygmaea* Thunberg, Prodr. Fl. Cap. 40. 1794. *Rapuntium pygmaeum* (Thunberg) C. Presl, Prodr. Monogr. Lobel. 22. 1836. *Laurentia pygmaea* (Thunberg) Sonder, in Harvey & Sonder, Fl. Cap. 3: 553. 1865. TYPE: South Africa. Cape Province: "Kapland, östliches Gebiet, in Querspalten des Berges Ribeck-Kastel," *Thunberg s.n.* (lectotype, designated by Wimmer (1953: 397), S not seen).

Wimmerella secunda (L. f.) L. Serra, M. B. Crespo & Lammers, comb. nov. Basionym: *Lobelia secunda* L. f., Suppl. Pl. 395. 1782. *Enchysia secunda* (L. f.) Sonder, in Harvey & Sonder, Fl. Cap. 3: 551. 1865. *Laurentia secunda* (L. f.) Kuntze, Revis. Gen. Pl. 3(2): 188. 1898. TYPE: South Africa. Cape Province: "Cap," *Herb. Linn. 1051.17* (lectotype, designated by Crespo et al. (1996: 119), LINN).

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Note added in proof. Because Article 37.3 was amended by adoption of Proposition 80 (Barrie, Taxon 47: 881–889. 1998) at the August 1999 International Botanical Congress, the names *Laurentia frontidentata* E. Wimmer and *L. mariae* E. Wimmer are validly published. They are the basionyms of the new combinations *Wimmerella frontidentata* (E. Wimmer) L. Serra, M. B. Crespo & Lammers and *W. mariae* (E. Wimmer) L. Serra, M. B. Crespo & Lammers, respectively.

Alloplectus martinianus, a New Species of Gesneriaceae from Ecuador

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ABSTRACT. *Alloplectus martinianus*, a new species of Gesneriaceae from Ecuador, is described. The species is distinctive for its long narrow leaves, densely villous short corollas, and unusual reticulations on the adaxial epidermis of the leaf.

This paper describes a new species of *Alloplectus* from Ecuador that is readily distinguished because of the combined character states of long narrow leaves, short pedicels, densely villous short corollas, and unique reticulations on the adaxial epidermis of the leaves.

Alloplectus Martius has a history of taxonomic confusion with *Columnea* L. (Wiehler, 1983), which has not been resolved with modern molecular techniques (Smith & Sytsma, 1994a, b, c; Smith & Carroll, 1997). These two genera are distinguished by the dehiscent fleshy fruits in *Alloplectus* and indehiscent berries in *Columnea* (Wiehler, 1973, 1983). This diagnostic fruit character is useful on fresh and live material, but plants without fruits are frequently difficult or impossible to identify. In addition, herbarium specimens with only immature dried fruits are difficult to determine as being dehiscent or not. Such confusion has been the case for the species described here. Specimens of this species have been attributed to *Columnea* by the author and by other specialists in the Gesneriaceae. The occurrence of fruits in one specimen (*Gentry 12590*) shows the dehiscence typical of *Alloplectus* and has permitted the proper placement of this species.

Alloplectus martinianus J. F. Smith, sp. nov. TYPE: Ecuador. Napo: road from Baeza to Tena, 5 km S of Baeza, mountain rain forest, 26 June 1983, *Bohlin & Bohlin 698* (holotype, US; isotype, GB). Figure 1.

Differt ab *Alloplecto boliviano* (Britton) Wiehler pedicellis brevioribus, foliis angustioribus.

Epiphytic or terrestrial, woody-based herbs with erect stems to 1.5 m long, 3–8 mm diam. (Fig. 1A), red-brown, appressed trichomes sericeous, denser toward apex. Internodes 0.4–5.0 cm long, leaf scars raised from the nodes. Leaves opposite, subequal, blades lanceolate, 4.0–13.9 × 1.1–3.3 cm, apices acute, bases cuneate, margin entire or serrulate, adaxially green, pannose with reticulations on epidermis (Fig. 1F) (reticulations may not be prominent on all leaves), abaxially green to rose, densely tomentose with yellow trichomes, pubescence of veins abaxially colored pink or red-purple. Petioles 0.5–2.4 cm, tomentose. Inflorescences of 2–5 flowers in axils of both leaf pairs (Fig. 1A), floral bracts lanceolate, 3.0 × 1–1.3 mm, apex acute, margin entire, tomentose. Pedicels 0.5–0.9 cm, erect in leaf axil, tomentose. Calyces campanulate, clasping corolla at base, lobes elliptic, equal in size, 0.8–1.8 × 0.20–0.50 cm, apex acute, margins entire or serrulate at apex, green, exterior and interior tomentose. Corollas yellow, gibbous at base, slightly ventricose (Fig. 1B), 1.3–1.7 cm long, 1.5–3.0 mm at base, 3.5–3.8 mm at widest point, 2.5–2.6 mm before limb, exterior densely villous with golden-yellow trichomes, interior mostly glabrous but with white capitate trichomes dorsally and distally (Fig. 1C). Lobes equal, 2.0 × 2.0 mm, semi-orbicular. Stamens included, filaments white, glabrous, adnate to corolla base for 2.5 mm then connate for 3.5 mm at base, anthers quadrate, 1.0–2.0 × 1.0–2.0 mm. Nectaries of 2 dorsal fused glands. Ovaries tomentose, 3.0 mm long, conical, styles reddish, glabrous to slightly pubescent at base, stigmas stomatomorphic, papillose. Fruits globose, 6–10 mm diam., red, villous. Seeds fusiform, red-brown to almost black, twisted, striate, 0.8 mm long.

Distribution. Known only from 1200 to 2500 m elevation in Ecuador from a small geographic area in Napo province; flowering March to December and fruiting in May to November.

Alloplectus martinianus is superficially and morphologically similar to *Columnea formosa* (C. V. Morton) C. V. Morton, to which specimens were earlier attributed. It differs from the latter species in several respects. First of all, the fruits are apparently dehiscent, although this character state was not immediately obvious from the initial specimens examined. However, it was clear from the fruits of *Gentry 12590* that this is a species of *Alloplectus*. Additionally, the pedicels of the new species are

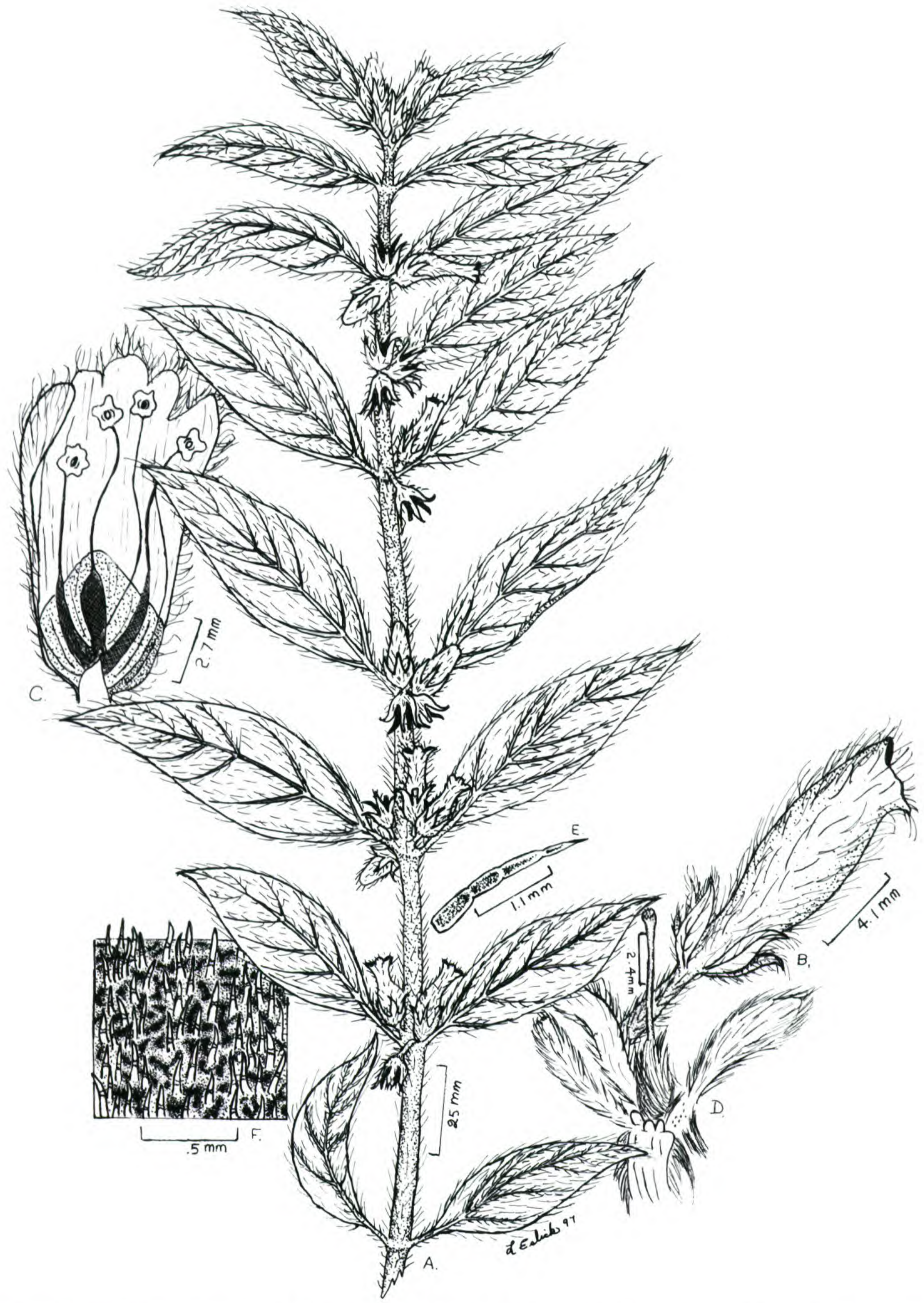

Figure 1. *Alloplectus martinianus* J. F. Smith. —A. Habit. —B. Flower with calyx cut open to show corolla base. —C. Corolla interior with stamens. The bases of the stamens were torn in the specimen this illustration was based on, and therefore do not reflect the full degree of connation seen in other flowers (see text for full description). —D. Gynoecium with calyx and nectaries. —E. Uniseriate trichome. —F. Adaxial leaf surface. From *Bohlin & Bohlin 698.*

conspicuously shorter than in *C. formosa* and other species of *Columnea*, and the corolla is smaller and shorter than in most species of *Alloplectus*. *Alloplectus martinianus* is also superficially similar to *Alloplectus bolivianus* (Britton) Wiehl. However, the latter species has longer pedicels, corollas, and petals and broader leaves. Additionally, *A. bolivianus* is generally much less pubescent than *A. martinianus*. Lastly, the reticulate epidermal pattern readily seen on many specimens at 10× magnification on the adaxial surface of the leaves is distinctive and not known from any other species of *Alloplectus*. It should be noted that this feature is not always present on all leaves of a collection. The pattern may be influenced by the age and condition of the leaf at the time of collection, as well as how it is dried. However, all specimens examined to date show at least a portion of one leaf from each specimen with the reticulations. The specific epithet honors the author's friend and companion, Steven G. Martin, of Boise, Idaho.

Paratypes. ECUADOR. **Napo:** Cosanga, 20 km S of Baeza, 20 Sep. 1977, *Maas, Berg & ter Welle 3008* (QCA, SEL, U); Río Panteor, SW of Borja, 22 Sep. 1980, *Holm-Nielsen et al. 26710* (K); Quijos, Sierra Azul, 2 May 1992, *Alvarez, Mosquera, Proaño & Viteri 396* (QCNE, US); 16.5 km NNE of Santa Rosa on road from Baeza to Lago Agrio, 19 Oct. 1971, *MacBryde 747* (US); junction Baeza–Lago Agrio road with Río Azuela, 27 Mar. 1972, *Dwyer & MacBryde 9636* (US); 23 km E of El Chaco, Quito–Lago Agrio road, 7 Nov. 1974, *Gentry 12590* (NY, US); 2.5 km N of Cosanga, 18 Feb. 1978, *Kirkbride & Chamba 4168* (NY, US); Baeza, 9 May 1990, *Palacios & Freire 5002* (QCNE, US); 17 km from Cosanga, 24 Aug. 1990, *Jaramillo, Grijalva & Grijalva 12142* (QCA); 11 km E of El Chaco, 22 Mar. 1989, *Huttel 1634* (QCA, QCNE); Santa Lucía de Bermejo, 15 Dec. 1993, *Alvarez, Brito, Romero & Guerrero 969A* (QCNE); environs of Baeza, Jan. 1979, *Besse, Tan & Halton 1156* (SEL).

Acknowledgments. I thank Lewis Eslick for the illustration of this species, Steven G. Martin for his support, Laurence Skog for comments on the manuscript and for forwarding several specimens for my study, and an anonymous reviewer for comments on the manuscript. Funding for this research was made available through NSF grant DEB-9317775 and a faculty research associates program grant from Boise State University.

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A New Combination in the Cactaceae, *Opuntia lutea*

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ABSTRACT. A new combination in the Cactaceae, *Opuntia lutea* (Rose) Solomon, is needed to bring one of the species treated in the *Flora de Nicaragua* into conformity with the generic concepts utilized in the *Flora.*

Historically, the genus *Nopalea* Salm-Dyck has been separated from *Opuntia* Miller subg. *Opuntia* based on floral morphology. In *Nopalea*, flowers have a more or less long-exserted style and stamens and the inner tepals are relatively short, erect, and imbricate, instead of spreading as in other species of *Opuntia.* This floral syndrome is an adaptation to hummingbird pollination (Porsch, 1938) and is not considered by many authors to be sufficient for generic recognition (Benson, 1982; Hunt, 1967; Hunt & Taylor, 1986, 1990). Thus, *Nopalea* would be considered a subgroup within *Opuntia.* Because the Opuntioideae, as a whole, have been inadequately studied and little is known about evolutionary relationships within the subfamily, it remains unclear what the relationships are between the species that have traditionally been included in *Nopalea* and the rest of the subfamily. In the *Flora de Nicaragua, Opuntia* is treated in its broad sense, including *Nopalea,* making necessary the following new combination:

Opuntia lutea (Rose) Solomon, comb. nov. Basionym: *Nopalea lutea* Rose, Contr. U.S. Natl. Herb. 12: 405, t. 58. 1909. TYPE: Guatemala. Zacapa: El Rancho, 300 m, 28 Dec. 1907, *W. A. Kellerman 7046* (holotype, US-535175; isotypes, MO-911486, US-535186).

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A New Combination in *Ampelocissus* (Vitaceae), a Victim of Historic Deforestation in Nicaragua

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ABSTRACT. A neotype is selected for *Vitis javalensis* Seemann, and *V. javalensis* is transferred to *Ampelocissus*. *Ampelocissus costaricensis* Lundell is reduced to synonymy under *Ampelocissus javalensis* (Seemann) W. D. Stevens & A. Pool, comb. nov. Changes in vegetation of the Javalí gold and silver mines region (Santo Domingo/La Libertad) of Chontales, Nicaragua, the original published locality of *V. javalensis*, are discussed.

In 1869, Berthold Seemann described *Vitis javalensis* Seemann based on material observed in the Department of Chontales, Nicaragua in the vicinity of the Javalí gold and silver mines. Living material was gathered and delivered to horticulturist William Bull of King's Road, Chelsea, England (Seemann, 1869).

J. E. Planchon transferred *Vitis javalensis* to *Cissus* as *Cissus javalensis* (Seemann) Planchon, where it was included in his monograph of Ampelideae under "*Cissus.*—Species pleraque dubiae" as a "nomen tantum" (Planchon, 1887). Bull's retail list of new Plants, ann. 1870, p. 5, was cited in reference. In J. A. Lombardi's manuscript Fl. Neotrop. Monogr. for Vitaceae-Gêneros *Ampelocissus*, *Ampelopsis* e *Cissus* (in press), Lombardi treats *Cissus javalensis* (Seemann) Planchon under "Nomes duvidosos e taxa excluídos." A holotype, Seemann s.n., assumed to be at BM, was not located.

In our efforts to prepare a written flora for Nicaragua, we are attempting to account for all names based on Nicaraguan material. Herbarium material of *Vitis javalensis* collected by Seemann was sought at the British Museum, where the primary set of Seemann's Nicaraguan material is housed, without success. Illustrations of *Vitis* or *Cissus javalensis* published by Seemann or Bull were also sought, again without success.

Seemann described *Vitis javalensis* as a species with simple leaves with acute apices, cordate bases, mucronately-dentate margins, "beautifully" velutinous adaxial surfaces and purplish abaxial surfaces, and bright scarlet flowers. This description does not correspond to any Central American species of *Cissus* or *Vitis*. However Seemann's description is consistent with Lundell's description (Lundell, 1937) and specimens of *Ampelocissus costaricensis* Lundell, with the exception that the hairs of the leaves of the latter are better described as arachnoid or floccose.

The genus *Ampelocissus* is not otherwise known from Nicaragua. *Ampelocissus costaricensis* is a species apparently currently restricted to wet, evergreen forests below 500 m in the Provinces of Limón, Costa Rica, and Bocas del Toro, Panama. The habitat of this region is similar to the presumed habitat of the Javalí mines region of Chontales, Nicaragua, at the time when Seemann made his collections, 1866–1871. Both Thomas Belt (1888) and Seemann (Anon., 1869) describe this as an area of high rainfall and rich forests. We have discovered 15 additional species collected in the region of the Javalí mines during this period. Most of the species range from Nicaragua into South America and are currently known from much wetter forests than those which now occur in the mines region. All but two of these species, including the one in question, are currently found in Nicaragua, but they tend to be found in the wet forests of Zelaya and Río San Juan Departments, or in remnant cloud forests of western Nicaragua, especially Cerro Oluma, Cerro Mombachito, Volcán Mombacho, and Volcán Maderas.

Belt's and Seemann's historical narratives, and the modern distribution of the species historically known from the Javalí mines region, suggest that the Cordillera Chonteleña, from southern Matagalpa through Boaco, Chontales, and Río San Juan Departments, has become dramatically drier in the last 150 years. Deforestation, for mining timbers, charcoal, and grazing land, has clearly changed the landscape directly and has probably indirectly changed the general climate of the region. What was once apparently wet, evergreen forest is now mostly scrubby savanna with patches of dry forest on rocky slopes, grading into cloud forests at higher elevations. The vegetation of the southernmost part of the Cordillera, in Río San Juan Department, is less altered but not well known. It is possible that future collection in this area will result in the re-

discovery in Nicaragua of species historically known from the Javalí mines region.

Neotypification and Synonymy

We assume, due to the failure of our own searches in addition to the failed previous attempts by Planchon and Lombardi, that it is unlikely that any original material of *Vitis javalensis* exists, and the selection of a neotype is therefore necessary (Greuter et al., 1994, Art. 9.6). On the basis of Seemann's description, a neotype is here selected, *V. javalensis* is transferred to *Ampelocissus*, and *Ampelocissus costaricensis* is placed in synonymy.

Ampelocissus javalensis (Seemann) W. D. Stevens & A. Pool, comb. nov. Basionym: *Vitis javalensis* Seemann, J. Bot. 7: 332. 1869. *Cissus javalensis* (Seemann) Planchon in A. DC. & C. DC., Monogr. Phan. 5: 624. 1887. TYPE: Costa Rica. Limón: Cordillera de Talamanca, Cantón de Matina, entre Río Barbilla y Quebrada Cañabral, subiendo por la fila, 10°01′N, 83°25′W, 100–300 m, 20 Oct. 1988 (fl), *Gerardo Herrera & Hernán Martínez M. 2228* (neotype, here designated, MO; isoneotype, CR not seen).

Ampelocissus costaricensis Lundell, Publ. Carnegie Inst. Wash. 478: 215. 1937. Syn. nov. TYPE: Costa Rica. Limón: Hacienda de Zent, without date (fl), United Fruit Company 383 (holotype, US).

Acknowledgments. We thank Dan Nicolson for his advice and encouragement and Mike Gilbert for searching for material at BM.

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A New Species of *Psychotria* Subgenus *Psychotria* from Nicaragua

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ABSTRACT. The new species *Psychotria hamiltoniana* C. M. Taylor is described based on recent collections from the Caribbean coast of Nicaragua; this species is related to *P. neillii* C. W. Hamilton & Dwyer.

RESUMEN. Se describe la especie nueva *Psychotria hamiltoniana* C. M. Taylor basada en colecciones recientes de la costa caribeña de Nicaragua; es afín a *P. neillii* C. W. Hamilton & Dwyer.

During study of recent collections from the Caribbean coast of Nicaragua, the following new species was discovered. It belongs to *Psychotria* L. subg. *Psychotria*, which was monographed for Central America by Hamilton (1989). The herbarium of the Universidad Nacional Autónoma de Nicaragua-León, where specimens of this new species are deposited, does not yet have an international acronym; it is here referred to as "HULE."

Psychotria hamiltoniana C. M. Taylor, sp. nov. TYPE: Nicaragua. Río San Juan, municipio de El Castillo, Reserva Indio-Maíz, Cerro El Diablo, 11°01′N, 84°12′W, 250 m, 9 Jan. 1997, *R. Rueda, I. Coronado, O. Auraúz & F. Flores 5618* (holotype, Universidad Nacional Autónoma de Nicaragua-León (HULE); isotype, MO-4895236). Figure 1.

Haec species a *Psychotria neillii* C. W. Hamilton & Dwyer foliorum majorum petiolis longioribus atque inflorescentiae axe breviore ac bracteis floralibus longioribus distinguitur.

Shrubs and small trees to 3 m tall, flowering at 2.5 m tall; stems terete, densely short-pilosulous often becoming glabrescent with age. Leaves paired; blades oblanceolate to obovate or occasionally lanceolate, 14–31 cm long, 6–16 cm wide, at apex acute to acuminate with tips to 20 mm long, at base cordulate with sinus to 12 mm deep, papyraceous, adaxially glabrous, abaxially moderately to densely pilosulous, often more densely so along costa and secondary veins; secondary veins 8–18 pairs, ascending to spreading but less than 90°, usually at least weakly looping to interconnect in an undulating submarginal vein with 1–2(3) usually rather weak intersecondary veins present between pairs of secondary veins, adaxially the costa and remaining venation plane, abaxially the costa prominulous to prominent and the secondary veins and reticulated minor venation prominulous; petioles 3–9 cm long, densely short-pilosulous; stipules densely short-pilosulous, caducous or sometimes persisting on distalmost 1–2 nodes, interpetiolar, triangular to lanceolate, 18–34 mm long, acute to very shortly bifid, usually somewhat asymmetrical and twisted, with a thickened basal triangular portion. Inflorescences and flowers not seen. Infructescences terminal, erect, with peduncles 2.5–3 cm long; panicles subglobose, 3–7 × 2–6 cm, with 2–3 sets of secondary axes, with the axes 4–6 per rank and unequal, with the remains of old flowers and developing fruits sessile in glomerules of 2–3 or usually separated along cymose branches; bracts all deltoid to ovate, 1.5–2.5 mm long, acuminate; peduncle, axes, and bracts apparently green, densely short-pilosulous to hirtellous or the bracts often glabrescent; fruits ellipsoid, ca. 5 × 3.5 mm, not flattened laterally, pilosulous to hirtellous, orange to red, with the persistent calyx limb ca. 1 mm long, puberulous to glabrescent, deeply lobed, lobes obtuse to rounded; pyrenes with 3–5 low, rounded to angled, longitudinal ridges.

Distribution, phenology, and habitat. In wet forest at 120–250 m, southeastern Nicaragua. Collected in fruit in January, February, and December.

This species is distinguished by its pilosulous pubescence on vegetative structures, red-black-drying color, obovate to oblanceolate, petiolate leaves that are cordulate at the base, shortly pedunculate inflorescences with relatively short, unequal axes that are produced 4–6 per rank, bracts 1.5–2.5 mm long, fruits orange to red at maturity, and pyrenes dorsally with low longitudinal ridges or angles. Although flowers have not been seen, these characters clearly distinguish this species. *Psychotria hamiltoniana* belongs to *Psychotria* subg. *Psychotria*, and within this, to "Group 1" of Hamilton (1989). Within "Group 1" it is similar to *P. neillii* C. W. Hamilton & Dwyer, which can be distinguished by its leaves 8–18 × 3–7.5 cm, petioles 2–8 mm long, stipules 6–14 mm long, peduncles 3–10 cm long, bracts subtending inflorescence

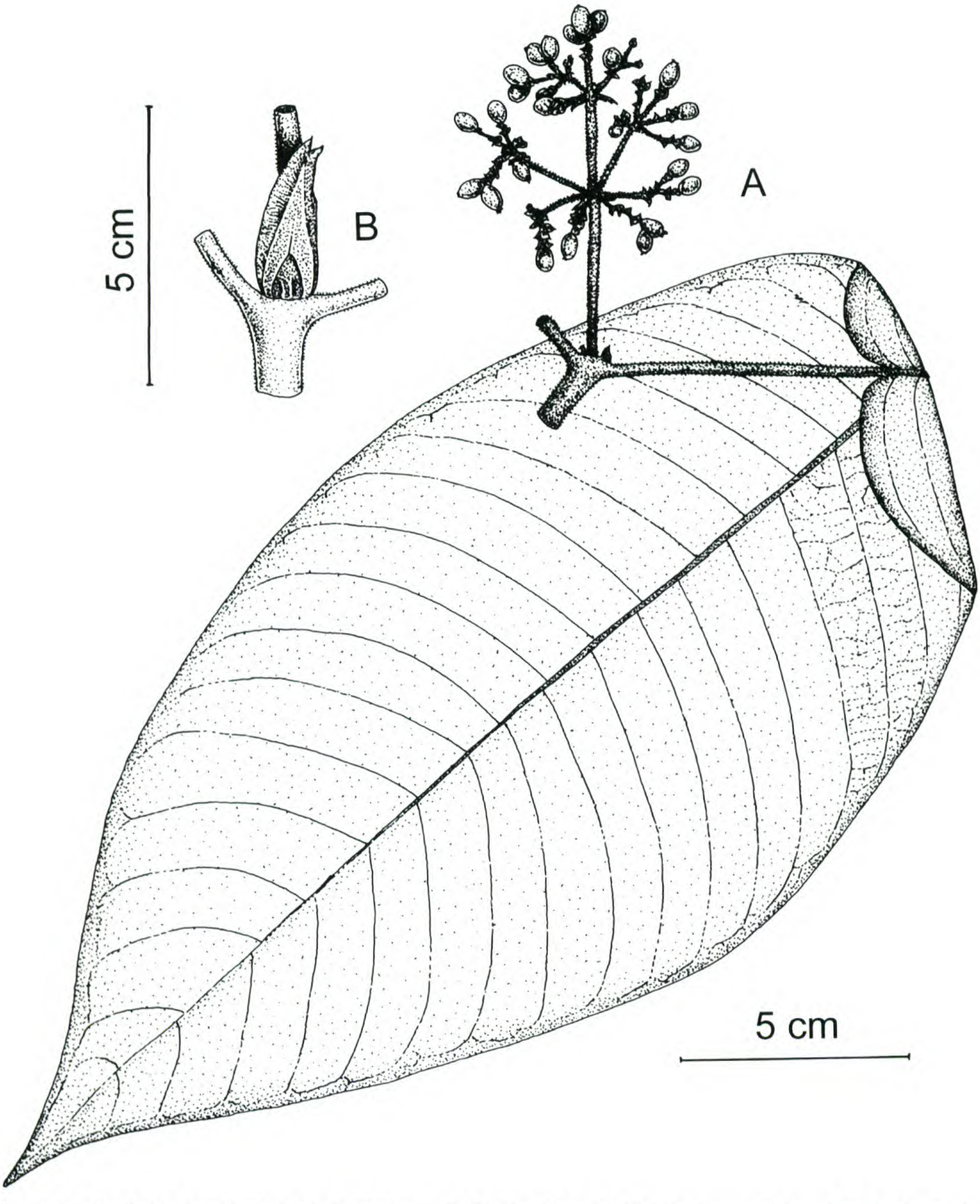

Figure 1. *Psychotria hamiltoniana* C. M. Taylor. —A. Fruiting branch with infructescence, based on *Rueda et al. 5618*. —B. Node with stipule, based on *Rueda et al. 5322*.

axes 3–4 mm long and floral bracts ca. 0.5 mm long, flowers subsessile to pedicellate with pedicels to 1 mm long, and calyx limb ca. 0.5 mm long. *Psychotria hamiltoniana* is also similar to *P. insignis* Standley, which can be distinguished by its stipules ca. 12 mm long, leaves with secondary veins 12–20 pairs and diverging 100–105° from the costa, sessile inflorescences with the secondary axes subequal at each node, and flowers all produced in glomerules. The specific epithet honors Clement W. Hamilton, who studied the Central American species of this group.

Paratypes. NICARAGUA. Río San Juan, municipio de El Castillo, Reserva Indio-Maíz, a lo largo del Caño El Pavón, a 3 km de su desembocadura en el Río Bartola, 11°01′N, 85°16′W, *Rueda et al. 5140* (MO, HULE); a 8

km de la cabecera del Río Bartola, 11°01′N, 84°14′W, *Rueda et al. 5266* (MO, HULE); a 8 km de la cabecera del Río Bartola, en dirección hacia el Cerro El Diablo, 11°01′N, 84°14′W, *Rueda et al. 5322* (MO, HULE); a lo largo del Caño Chontaleño, 11°07′N, 84°12′W, *Rueda et al. 5810* (MO, HULE).

Acknowledgments. I thank the *Flora de Nicaragua* Project for help with study of the Nicaraguan materials and preparation of this manuscript; R. E. Gereau for preparation of the Latin text; and Ricardo Rueda for access to specimens and providing additional information.

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Una Especie Nueva de *Posoqueria* (Rubiaceae) de la Guayana Colombiana

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RESUMEN. Se describe e ilustra la especie nueva *Posoqueria tarairensis* C. M. Taylor & R. Cortés-Ballén (Rubiaceae), que abunda en los bosques de la Serranía de Taraira en el sureste colombiano. La especie posee hojas esclerófilas, una adaptación típica a los hábitats con suelos arenosos pobres en nutrientes, característicos de la región Guayana.

ABSTRACT. The new species *Posoqueria tarairensis* C. M. Taylor & R. Cortés-Ballén (Rubiaceae), common in the Serranía de Taraira, southeastern Colombia, is here described and illustrated. This species shows sclerophyllous adaptations to sandy soils that are poor in nutrients, a habitat that is typical in the Guayana region.

Durante la primera exploración de la Serranía de Taraira en el sureste de Colombia, lo cual es floristicamente afín con la región biogeográfica de la Guayana, se descubrió una especie nueva de *Posoqueria* que se describe a continuación. Steyermark presentó las características de *Posoqueria* (Steyermark, 1974) y una sinopsis de los miembros sudamericanos de este género neotropical (Steyermark, 1967).

Posoqueria tarairensis C. M. Taylor & R. Cortés-Ballén, sp. nov. TIPO: Colombia. Vaupes: Serranía de Taraira, 10 km al NO del Raudal de la Libertad, alrededores de la parcela #1, bosque de catinga, 00°58′S, 69°45′W, 250 m, 1 Sep. 1993 (fl), *J. Rodriguez 188* (holótipo, COL; isótipos, MO-5060886, UDBC).

Haec species a similibus foliorum coriaceorum sat parvorum venatione secundaria et minore non manifesta, tubo corollino 7.5–10.3 cm longo etiam fructu ca. 3 cm diam. exocarpio 1.0–2.5 mm crasso distinguitur.

Arbustos o arbolitos hasta de 2 m de altura, algo suculentos, con órganos vegetativos glabros. Hojas opuestas; lámina elíptico-oblonga, de 6–13.5 × 3–5.5 cm, con ápice y base obtusos hasta redondeados, coriácea, haz lustroso, márgenes ligeramente convolutos, costa prominente en ambas caras, 3–4 pares de venas secundarias poco notorias o no evidentes, las de orden menor muy poco o no evidentes; peciolos de 8–18 mm de largo; estípulas interpeciolares, deltoides, 3–5 mm de largo, enteras, deciduas con las hojas. Inflorescencias cimosas, cortamente pubérulas, pedúnculos de 7–10 mm de largo, porción ramificada de la cima de 0.5–1.5 cm de largo (excluyendo flores y frutos), brácteas deltoides hasta angostamente triangulares, 1–2 mm de largo, agudas, enteras o cilioladas, pedicelos 3–4 mm de largo; flores ca. de 8 por inflorescencia; hipanto (ovario ínfero) turbinado, 2.5–3 mm de largo, glabro o cortamente pubérulo; limbo calicino 1.2–1.5 mm de largo, glabro, lóbulos hasta ca. ¼ del largo, deltoides a anchamente triangulares, obtusos, márgenes escariosas y cilioladas; corola hipocraterimorfa, blanca, un poco carnosa, externamente glabra o diminutamente pubérula sobre los lóbulos, internamente glabra excepto en la garganta y en la parte basal de los lóbulos donde es moderadamente vilosa; tubo de 7.5–10.3 cm de largo, 1.5–2 mm de diámetro, lóbulos ligulados, ca. 12 mm de largo, ca. 4 mm de ancho, redondeados, con margen ciliolado, con prefloración quincuncial; estambres insertos justamente debajo de la garganta, filamentos de 2–2.5 mm de largo, aplanados, ca. 0.8 mm de ancho, anteras lanceoloides, ca. 4.5 mm de largo, lóculos dorsalmente pubérulos a pilósulos, con un apéndice apical, glandular, deltoide, de ca. de 0.8 mm de largo y dos apéndices basales (uno por lóculo) ligulados, glandulares, de ca. de 0.5 mm de largo; estilo filiforme, aplanado, de ca. de 3.8 cm de largo y 0.3 mm de ancho; estigma bifurcado, viloso, de ca. de 1.5 mm de largo, lóbulos de ca. de 0.2 mm de largo. Frutos globosos, de 3 cm de diámetro, lisos, verdes, glabros, pared de 1–2.5 mm de gruesa; semillas anguladas, de 8–9 mm de largo, lisas.

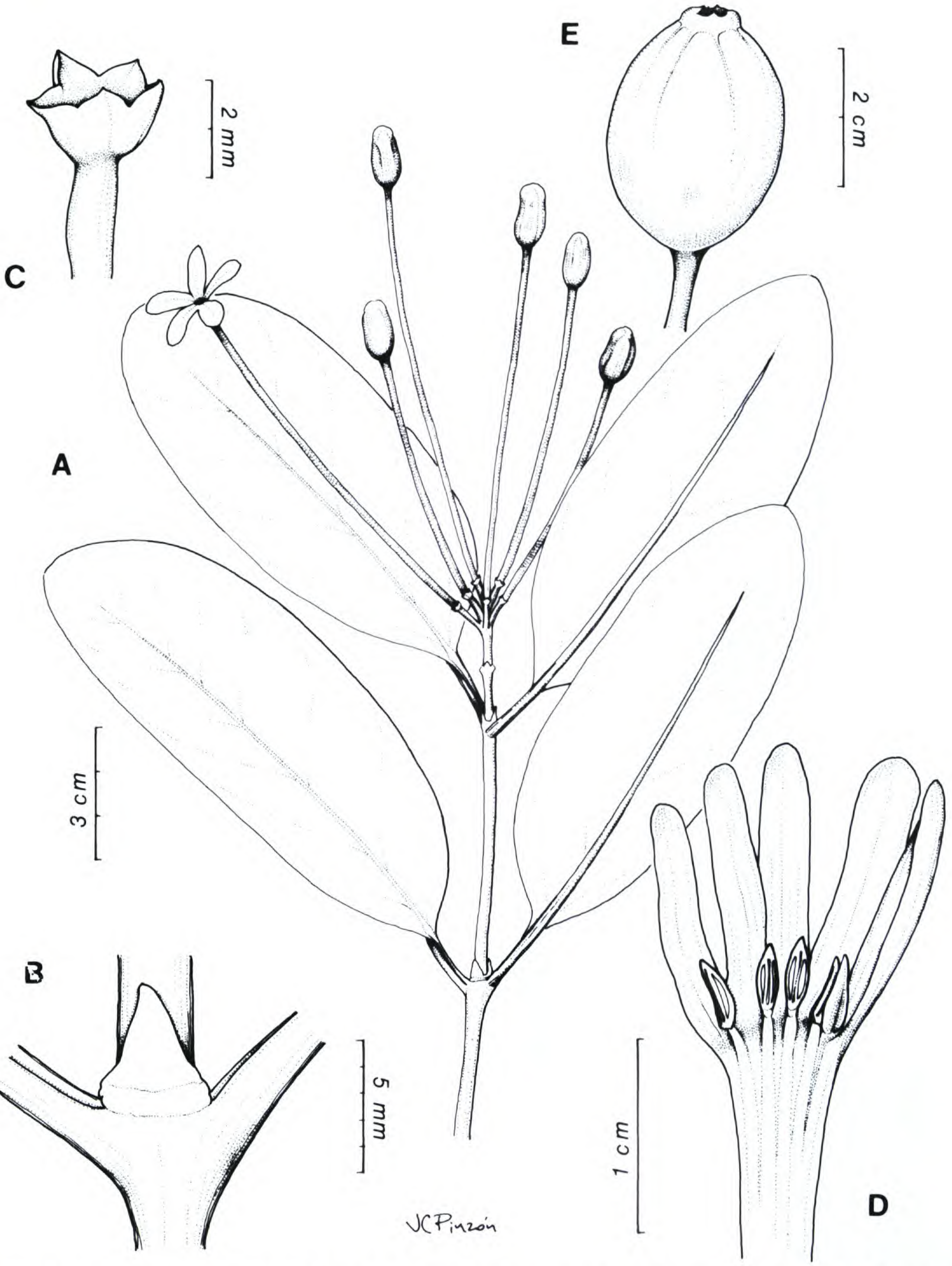

Figura 1. *Posoqueria tarairensis* C. M. Taylor & R. Cortés-Ballén. —A. Ramita florífera. —B. Estípula. —C. Limbo calicino. —D. Garganta de la corola, parcialmente disectada. —E. Fruto. A–D de *Rodríguez 188*; E de *Cortés & Rodríguez 818*.

Distribución y fenología. Conocida sólo de la localidad típica; colectada con flores en septiembre y con frutos en agosto.

Esta especie se distingue de otras especies de *Posoqueria* por las hojas coriáceas y relativamente pequeñas con ápices obtusos o redondeados y la venación muy poco notoria o no evidente, las corolas con el tubo corto con relación a las demás especies de *Posoqueria* y los frutos con pared relativamente delgada. Además esta especie habita en bosques de dosel abierto caracterizados por especies de porte bajo y diámetros reducidos que crecen sobre suelos arenosos y pobres en nutrientes, denominados bosques de catinga. Esta es la única especie de *Posoqueria* conocida en este hábitat, y presenta adaptaciones típicas a suelos pobres en nutrientes, tales como las hojas de tamaño reducido, coriáceas, ceráceas y con ápices cortos ("esclerófilas") y el hábito relativamente bajo.

El nombre se refiere a la localidad típica.

Parátipo. COLOMBIA. **Vaupés:** Serranía de Taraira, 10 km al NO del Raudal de la Libertad, alrededores de la parcela # 1, bosque de catinga, 00°58′S, 69°45′W, 250 m, 24 July 1993, *R. Cortés & J. Rodríguez 543* (COL estéril), 26 July 1993, *R. Cortés & J. Rodríguez 601* (COL estéril), 8 Aug. 1993, *R. Cortés & J. Rodríguez 818* (COL, MO).

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Nuevos Taxones de Rubiaceae de la Costa Pacífica de Colombia y Ecuador

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RESUMEN. Las nuevas especies *Coussarea sancti-ciprianii* C. M. Taylor, *Duroia laevis* Devia, Persson & C. M. Taylor, *Duroia sancti-ciprianii* Devia, Persson & C. M. Taylor, *Faramea ampla* C. M. Taylor, *Faramea monsalveae* C. M. Taylor, *Faramea calimana* C. M. Taylor y *Psychotria monsalveae* C. M. Taylor y la subespecie nueva *Coussarea loftonii* subsp. *calimana* C. M. Taylor se describen, basadas en material colectado durante los proyectos de inventarios florísticos en Bajo Calima y el río Escalerete en la región de la costa pacífica del departamento del Valle del Cauca, Colombia; las distribuciones de algunas de ellas se extienden hasta el departamento del Chocó en el norte y al noroeste de Ecuador en el sur.

ABSTRACT. The new species *Coussarea sancti-ciprianii* C. M. Taylor, *Duroia laevis* Devia, Persson & C. M. Taylor, *Duroia sancti-ciprianii* Devia, Persson & C. M. Taylor, *Faramea ampla* C. M. Taylor, *Faramea monsalveae* C. M. Taylor, *Faramea calimana* C. M. Taylor, and *Psychotria monsalveae* C. M. Taylor, and the new subspecies *Coussarea loftonii* subsp. *calimana* C. M. Taylor are here described based on material collected for the floristic inventory of the Bajo Calima and Río Escalerete project regions in coastal Valle del Cauca Department, Colombia; several of these species range north to Chocó Department and south into northwestern Ecuador.

Durante inventario y estudio florístico de dos sítios en bosque pluvial cerca de Buenaventura, en la costa pacífica de Colombia, los siguientes taxones nuevos se descubrieron. Ambos sítios se encuentran en la región fitogeográfica del Chocó (Gentry, 1986, Forero, 1982). La región de Bajo Calima ha sido descrita por Faber-Langendoen y Gentry (1991) y Ladrach y Wright (1995); el otro sítio cercano es la Reserva Natural Río Escalerete, que es generalmente similar. El rango de distribución de algunas de estas especies se extiende hasta el noroeste de Ecuador, en la misma región fitogeográfica.

Coussarea loftonii (Dwyer & M. V. Hayden) Dwyer subsp. **calimana** C. M. Taylor, subsp. nov. TIPO: Colombia. Valle: municipio de Buenaventura, Bajo Calima, Concesión Pulpapel/Buenaventura, 3°55'N, 77°W, ca. 100 m, 6 mar. 1985, *M. Monsalve B. 759* (holótipo, CUVC; isótipo. MO-3332908). Figura 1.

Haec subspecies a subspecie typica limbo calycino 4–5 mm longo, fructu ca. 2.0 × 1.5 cm atque foliis abaxialiter foveolis glabris in axillis nervorum secundariorum munitis distinguitur.

Arbustos o arbolitos hasta 12 m de alto, glabros. Hojas con láminas elípticas, 6–18 × 2–7 cm, con ápice acuminado con acumen 5–15 mm de largo, con base aguda a obtusa, cartáceas, glabras en ambas superficies; venas secundarias 4–7 pares, con domácios glabros del tipo cripto; pecíolos 6–12 mm de largo, glabros; estípulas interpeciolares o ligeramente tubulares, caducas, glabras, porción interpeciolar redondeada, 3–4 mm de largo, yemas ovoi-

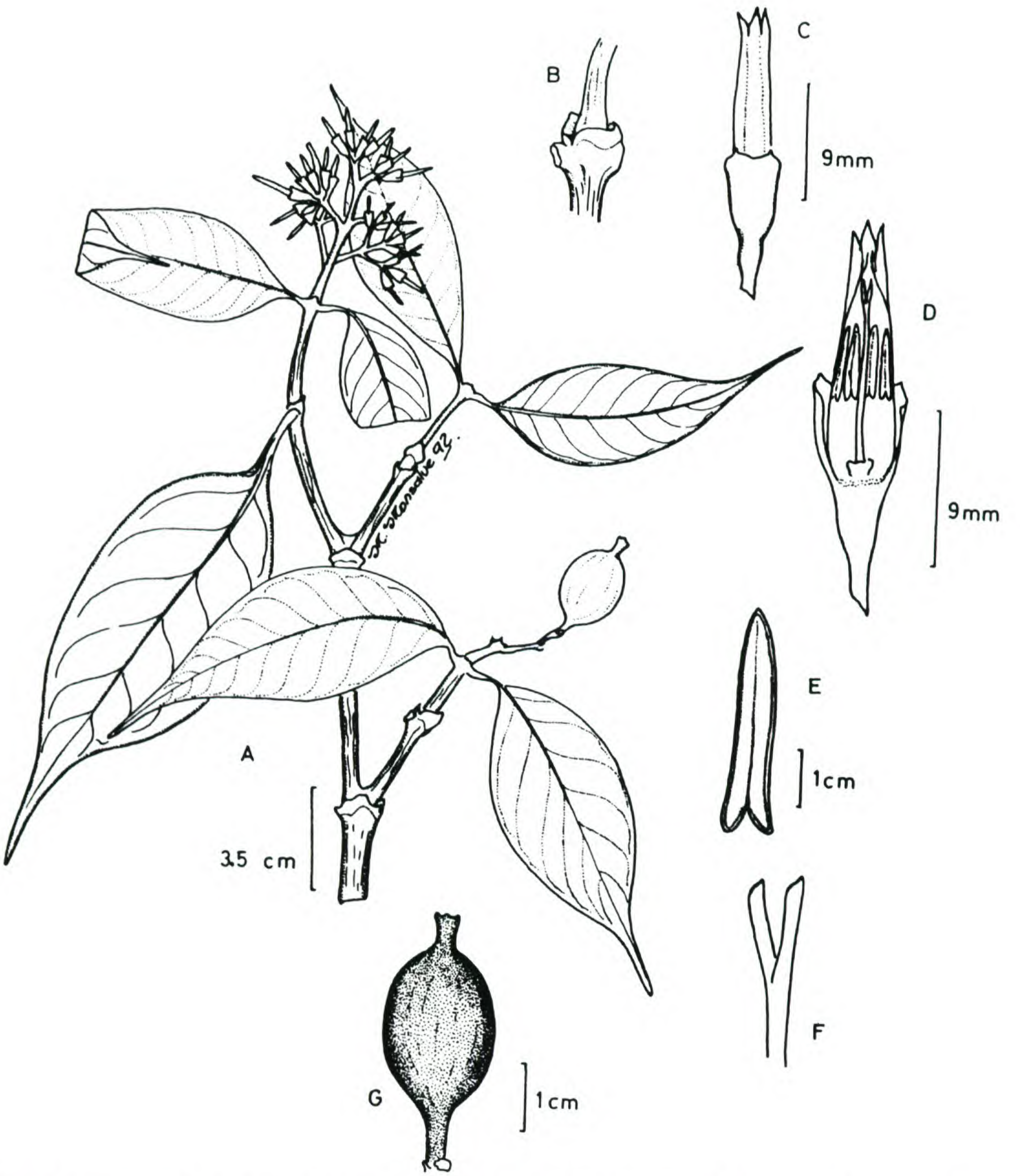

Figura 1. *Coussarea loftonii* subsp. *calimana* C. M. Taylor; de *Monsalve 584*. —A. Rama con inflorescencia y fruto. —B. Estípula. —C. Botón floral. —D. Botón floral parcialmente disectado. —E. Antera. —F. Estigma. —G. Fruto. B, C a la misma escala; E, F a la misma escala.

des a subglobosas. Inflorescencias terminales, paniculadas, glabras, pedúnculos ca. 1 cm de largo, panículas triangulares a redondeadas, ca. 3 × 3 cm, brácteas ausentes, pedicelos 1–2 mm de largo en címulas de 2–3; flores en botón con limbo calicino 4–5 mm de largo, glabro, denticulado; corola en botón glabra, blanco-verdosa. Frutos lisos, ca. 2 × 1.5 cm.

Distribución, habitat y fenología. En bosque pluvial a 100–130 m en la costa pacífica del Valle del Cauca en Colombia; localmente infrecuente. Colectada con flores en botón en septiembre, con frutos en marzo.

La especie *Coussarea loftonii* se encuentra desde el oeste de Colombia hasta Panamá central; las plantas de Panamá tienen el limbo calicino 2–3.5

mm de largo con dientes lineares, los frutos ca. 13 × 10 mm y las hojas en el envés con domacios abiertos y pilósulos. Esta nueva subespecie se distingue por el limbo calicino mas largo con dientes muy cortos, los frutos mas grandes y las hojas en el envés con domacios del tipo cripto que son glabros y casi cerrados. Las corolas maduras de las plantas colombianas no se han visto, pero sus caracteres vegetativos son casi iguales a las plantas panameñas, y la similaridad en general entre las plantas de Panamá y las del oeste de Colombia sugiere que las poblaciones constituyen dos grupos no completamente aislados. Las plantas colombianas se describen al nivel de subespecie porque parecen distintas en la distribución geográfica, con poca variación intermedia evidente en las muestras disponibles.

El epiteto se refiere a la región de donde viene el tipo.

Parátipos. COLOMBIA. **Valle:** municipio de Buenaventura, Bajo Calima, Concesión Pulpapel/Buenaventura, 3°55′N, 77°W, *Monsalve 584* (CUVC, MO), *1696* (CUVC, MO); Reserva Natural Río Escalerete, *Devia et al. 4324* (MO, TULV, estéril), *5347* (MO, TULV, estéril).

Coussarea sancti-ciprianii C. M. Taylor, sp. nov. TIPO: Colombia. Valle: municipio de Buenaventura, corregimiento Córdoba, vereda San Cipriano, Reserva Natural Río Escalerete, 100 m, 13 abr. 1993, *W. Devia, D. Cárdenas & A. Cruz 3966* (holótipo, TULV; isótipos, MO-4625143, MO-4625148). Figura 2A.

Haec species a congeneris stipulis deltatis 5–13 mm longis, foliis efoveolatis, inflorescentiis subcylindricis, limbo calycino truncato ca. 2 mm longo atque corollae tubo lobulis longiore distinguitur.

Arbustos o arbolitos hasta 7 m de alto, glabros. Hojas con láminas elípticas a ovadas, 12–30.5 × 4.8–17 cm, con ápice agudo a acuminado con acumen hasta 8 mm de largo, con base cuneada a obtusa, papiráceas a cartáceas, glabras; venas secundarias 6–10 pares, sin domácios, en la haz la costa promínula, las venas secundarias planas a promínulas y la venación menor plana, en el envés la costa prominente y las venas secundarias y la venación menor promínulas; pecíolos 12–40 mm de largo, glabros; estípulas interpeciolares o ligeramente tubulares, caducas, glabras, porción interpeciolar deltoide, 5–13 mm de largo, yemas lanceoloides, usualmente angostas. Inflorescencias terminales, paniculadas, glabras o puberulentas, pedúnculos 3–7.5 cm de largo, articulados en la mitad basal, en la articulación con una estípula sin hojas, panículas subcilíndricas, 5–7 × 2–6 cm, ejes secundarios no o poco desarrollados, brácteas hasta 0.5 mm de largo, pedicelos 2–3 mm de largo; flores producidas en címulas de 2–3; limbo calicino ca. 2 mm de largo, glabro, truncado, entero o diminutamente ciliolado; corola en botón blanca, externamente puberulenta, tubo ca. 14 mm de largo, lobos ca. 7 mm de largo. Frutos lisos, ca. 18 × 12 mm.

Distribución, habitat y fenología. En bosque pluvial a 30–140 m, en la costa Pacífica del Valle del Cauca en Colombia. Colectada con flores en abril, con frutos en abril, julio y agosto.

Esta especie se distingue por las estípulas deltoides 5–13 mm de largo, las hojas sin domacios, las inflorescencias subcilíndricas, el limbo calicino truncado ca. 2 mm de largo y las corolas con el tubo mas largo que los lobos. El epiteto se refiere a la localidad de donde viene el tipo.

Parátipos. COLOMBIA. **Valle**: municipio de Buenaventura, along road from Buenaventura to Málaga, Km. 52.4 (from beginning of road at Gallinero), 4°03′N, 77°05′W, *Croat & Bay 75712* (CUVC, MO); corregimiento Veneral, Río Yurumanguí, Quebrada Querre, *Devia et al. 2974* (MO, TULV); corregimiento Córdoba, vereda San Cipriano, Reserva Natural Río Escalerete, 3°50′N, 76°35′W, *Devia et al. 4041* (MO, TULV), *4194* (MO, TULV), *4438* (MO, TULV), *5265* (MO, TULV); Bajo Calima, Concesión Pulpapel/Buenaventura, 3°55′N, 77°W, *Monsalve 172* (CUVC, NY), *248* (CUVC, MO), *1516* (CUVC, MO).

Duroia laevis Devia, Persson & C. M. Taylor, sp. nov. TIPO: Colombia. Valle: municipio de Restrepo, Campamento Río Azul, El Chanco, Proyecto Calima III de la CVC, 04°00′N, 76°00′W, 550 m, 18 mar. 1986, *W. Devia A. 1266* (holótipo, TULV; isótipos, GB, MO-4671198, MO-4671199). Figura 3A, B.

Haec species a *Duroia soejartoi* D. R. Simpson pubescentia strigulosa atque foliis papyraceis basi cordulatis distinguitur.

Arboles hasta 25 m de alto; tallos cuadrangulares, estrigulosos a glabrescentes. Hojas opuestas; láminas elípticas a ampliamente elípticas, 16–40(–62) × 12–28(–37) cm, papiráceas, con ápice obtuso a redondeado y brevemente acuminado con acumen 3–8 mm de largo, con base cordulada, en la haz glabras excepto pubérulas a estrigulosas en la costa y las venas secundarias, en el envés pubérulas en toda la superficie; venas secundarias 15–20 pares, en la haz la costa y las venas secundarias planas a subsulcadas y la venación menor reticulada y promínula, en el envés la costa y las venas secundarias prominentes y la venación menor promínula; pecíolos seríceos, 1.4–5 cm de largo; estípulas densamente velutino-seríceas, caducas en una caliptra entera, hasta 28 cm de largo,

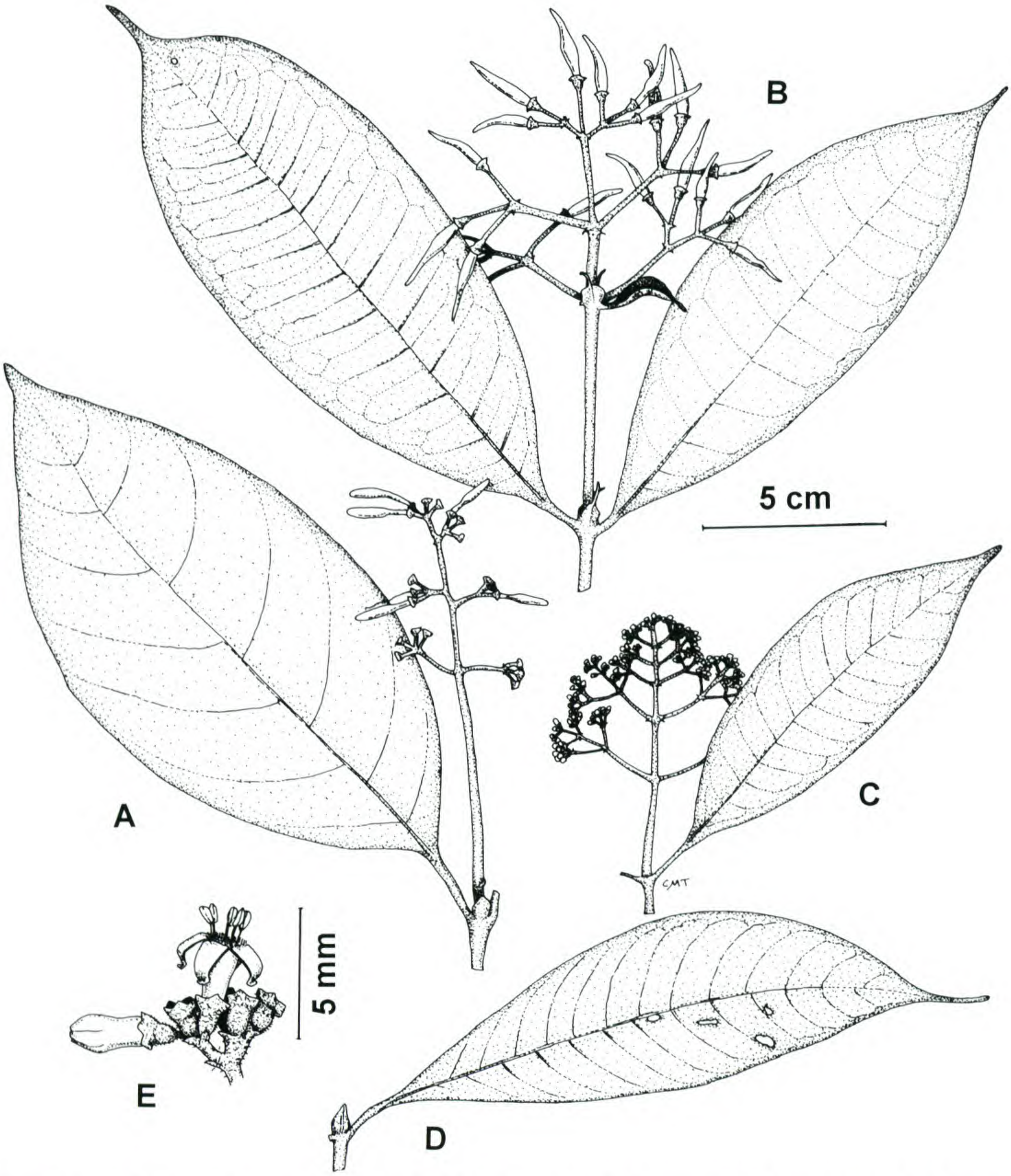

Figura 2. —A. *Coussarea sancti-ciprianii* C. M. Taylor, ramita con inflorescencia; de *Devia 3966*. —B. *Faramea calimana* C. M. Taylor, ramita con inflorescencia; de *Devia 3061*. C–E, *Psychotria monsalveae* C. M. Taylor; de *Croat 57527*. —C. Ramita con inflorescencia. —D. Hoja con ápice de la ramita con estípula. —E. Címula con flor. A–D a la escala de 1 cm; E a la escala de 5 mm.

aguda, algo aplanada desde los lados intrapeciolares. Inflorescencias y flores enteras no observadas; corola estaminada (encontrada en el suelo), blanca, hipocrateriforme con el tubo gradualmente ensanchado desde la base, externamente serícea, internamente glabra, 18–25 mm de largo, 3–4 mm de diám. cerca de la base, 6–8 mm de diám. cerca de la garganta, lobos 6, angostamente triangulares, 25–28 mm de largo, 5–7 mm de ancho en la base, agudos a acuminados; anteras sésiles, ca. 13 × 1 mm, incluidas; estilo ca. 22 mm de largo, estigma bilobulado, ca. 9 mm de largo; ovario aparentemente unilocular, placentación aparentemente parietal. Frutos terminales, solitarios (–3), elipsoides, hasta 8.5 × 5.5 cm, lisos, estrigulosos a glabrescentes, verde-parduzcos.

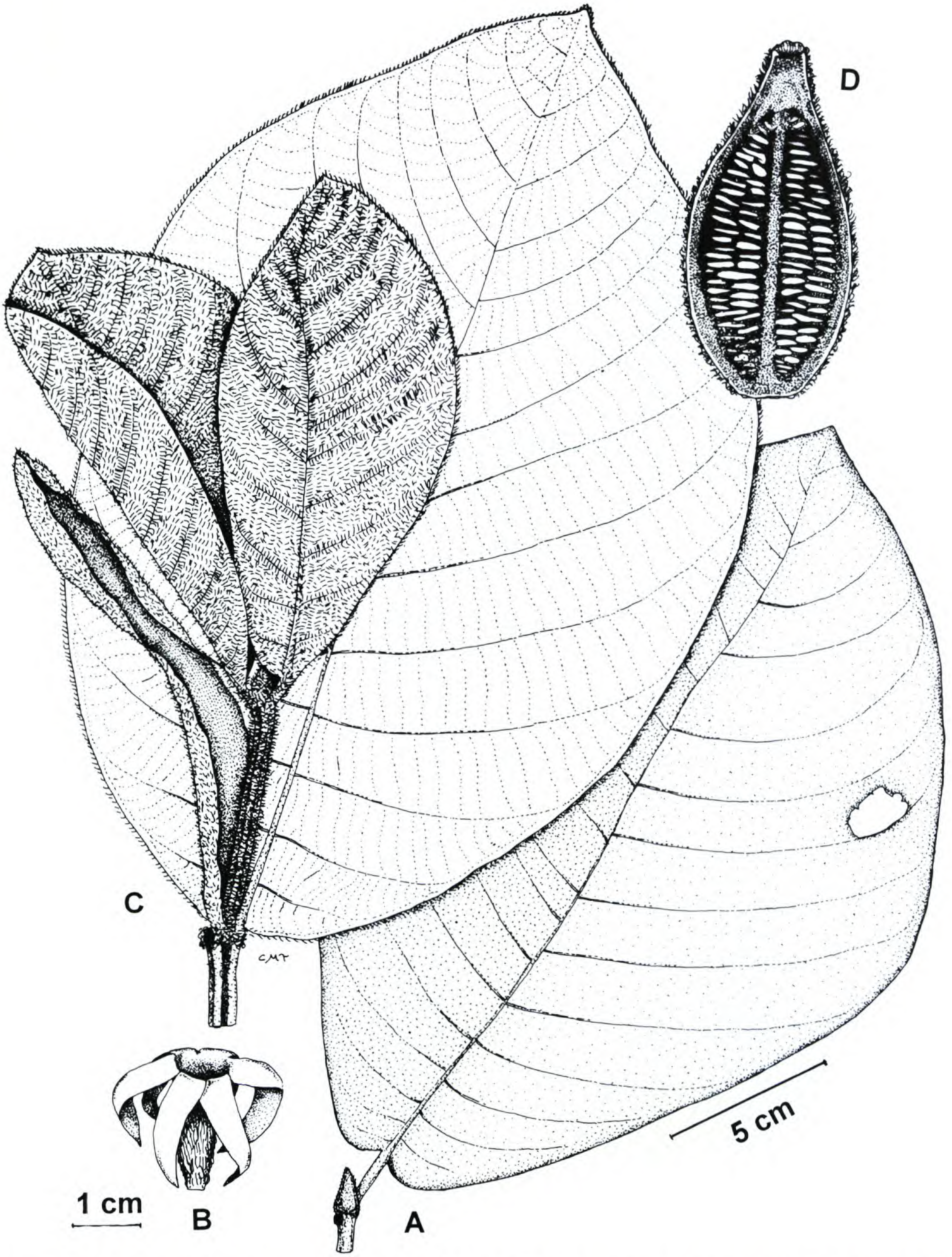

Figura 3. A, B, *Duroia laevis* Devia, Persson & C. M. Taylor. —A. Ramita con ápice y estípula; de *Aulestia et al. 375*. —B. Flor estaminada; de *Forero et al. 3273*. C, D, *Duroia sancti-ciprianii* Devia, Persson & C. M. Taylor. —C. Ramita estéril; de *Devia 5050*. —D. Fruto; de *Devia 5268*. A, C y D a la misma escala.

Distribución, habitat y fenología. En bosque pluvial a 130–600 m, en la costa pacífica del Chocó en Colombia al noroeste de Ecuador, en la provincia de Esmeraldas; localmente ocasional. Colectada con flores es febrero, con frutos en marzo y septiembre.

Esta especie se distingue por sus hojas opuestas y corduladas en la base, la pubescencia adpresa y típicamente estrigulosa, y los frutos lisos y estrigulosos a glabrescentes. El epiteto se refiere a los frutos lisos y la ausencia general de pubescencia notable de esta especie. La especie mas similar es *Duroia soejartoi* D. R. Simpson, descrita de esta misma región general (Simpson, 1982); *D. soejartoi* se distingue por su pubescencia generalmente hirsuta y sus hojas coriáceas a subcoriáceas con la base aguda y decurrente.

Parátipos. COLOMBIA. **Chocó:** carretera Medellín–Quibdó, adelante de la Ciudad Bolívar, Km 171, río La Playa, *Forero et al. 1079* (COL, MO); municipio de Nóvita, ladera norte del Cerro Torrá, filo al O del río Surama, camino al Alto del Oso, 4°55′N, 76°25′W, *Forero et al. 3273* (COL); Quibdó–Medellín road, 33 km E of Tutunendo, 5°43′N, 76°22′W, *Gentry & Rentería 24172* (COL). **Valle:** municipio Buenaventura, corregimiento Córdoba, vereda San Cipriano, Reserva Natural Río Escalerete, en la parcela permanente, 3°49′N, 76°52′W, 130 m, *Devia et al. 4748* (JAUM, MO, TULV), *4754* (JAUM, MO, TULV), *4834* (JAUM, MO, TULV), *4848* (JAUM, MO, TULV), *4872* (JAUM, MO, TULV), *4978* (JAUM, MO, TULV), *5145* (JAUM, MO, TULV), *5940* (JAUM, MO, TULV) [todos estériles]. ECUADOR. **Esmeraldas:** cantón San Lorenzo, parroquia Mataje, Reserva Etnica Awá, 1°08′N, 78°33′W, 200 m, *Aulestia et al. 375* (GB, MO, QCNE); cantón Eloy Alfaro, parroquia Luis Vargas Torres, Reserva Ecológica Cotacachi-Cayapas, río Santiago, Estero Angostura, 00°49′S, 78°45′W, *Tirado et al. 717* (GB, MO, QCNE).

Duroia sancti-ciprianii Devia, Persson & C. M. Taylor, sp. nov. TIPO: Colombia. Valle: municipio de Buenaventura, Bajo Calima, concesión Pulpapel, S.A. [de Cartón de Colombia], frente Hans, km 22 vía Málaga, 20 m, 2 mar. 1990, *W. Devia A. 3063* (holótipo, TULV; isótipo, MO-4671202). Figura 3C, D.

Haec species a *Duroia soejartoi* D. R. Simpson pubescentia patente pilosa ad hirsuta, petiolis brevioribus, foliorum venatione supra plerumque sulcata, stipulis usque ad 14.5 cm longis atque inflorescentiis congestis distinguitur.

Arboles hasta 15 m de alto; tallos cuadrangulares, patente-pilosos a glabrescentes. Hojas opuestas; láminas elípticas a ovadas u obovadas, 19–40 × 10–29.5 cm, cartáceas, con ápice obtuso a subagudo y brevemente acuminado con acumen 3–10 mm de largo, con base cuneada a redondeada, en la haz pilosas o hirsutas esparcidamente en la lámina y densamente en la costa y las venas secundarias, en el envés moderadamente pilosas o hirsutas en toda la superficie; venas secundarias 9–19 pares, en la haz la costa, las venas secundarias y la venación menor planas a frecuentemente sulcadas, en el envés la costa y las venas secundarias prominentes y la venación menor promínula; pecíolos pilosos a hirsutos, 6–20 mm de largo; estípulas densamente pilosas a hirsutas, caducas, alargándose en un cilíndro que se rompe por un lado y persistiendo un rato como una estructura espatácea, hasta 14.5 cm de largo, el conjunto agudo. Inflorescencias estaminadas congestionadas, con ca. 20 flores; flores estaminadas con cáliz externamente densamente seríceo a hirsuto, internamente esparcidamente seríceo, tubo 10–14 mm de largo, truncado, con lobos 6, filiformes, ca. 2 mm de largo; corola en botón blanca, hipocrateriforme a ligeramente infundibuliforme, externamente densamente retrorso-sericea, tubo hasta 15 mm de largo, lobos 6, ca. 12 mm de largo, externamente densamente antrorso-seríceos; anteras sésiles, incluidas, ca. 9 × 0.5 mm; estilo ca. 16 mm de largo, estigma bilobulado, ca. 8 mm de largo; ovario aparentemente unilocular, placentación aparentemente parietal. Frutos terminales, solitarios (–3), elipsoides a ovoides, 7.5–8.5 × 4–5.5 cm, lisos, pilosos a hirsutos, verde-parduzcos.

Distribución, habitat y fenología. En bosque pluvial a 20–130 m, en la costa pacífica del Chocó al Valle del Cauca en Colombia; localmente frecuente con semilleros y plantas jóvenes comunes en sítios con luminosidad relativamente alta del sotobosque. Colectada con flores en botón en abril, con frutos en marzo, septiembre y octubre.

Esta especie se distingue por las hojas opuestas, obtusas a redondeadas en la base y con la venación frecuentemente sulcada en la haz, la pubescencia patente y pilosa a hirsuta, la inflorescencia congestionada y los frutos lisos y pilosos a hirsutos. El epiteto se refiere a la comunidad de San Cipriano, protectora de la reserva natural "Río Escalerete" y colaboradora en su estudio botánico. La especie mas similar es *Duroia soejartoi*, descrita de esta misma región general y a la cual varias muestras de *D. sancti-ciprianii* fueron asignadas por Simpson (1982). No obstante, *D. soejartoi* se distingue por su pubescencia adpresa, sus hojas agudas en la base con la venación plana en la haz, sus pecíolos 1.5–2 cm de largo y sus inflorescencias estaminadas pedunculadas.

Parátipos. COLOMBIA. **Chocó:** río Serrano, afluente del río Atrato, 4–6 km arriba de Guyabal, *Forero et al. 1365* (COL). **Valle**: Bajo Calima, *Cabrera 575* (COL, F);

río Cajambre, Barco, 3°28′N, 76°57′W, *Cuatrecasas 17144* (F); río Calima, La Trojita, *Cuatrecasas 16588* (F; estéril); municipio Buenaventura, corregimiento Córdoba, vereda San Cipriano, Reserva Natural Río Escalerete, *Devia et al. 3948* (GB, MO); Reserva Natural Río Escalerete, en la parcela permanente, 03°49′N, 76°52′W, 130 m, *Devia et al. 5038* (JAUM, MO, TULV; estéril), *Devia et al. 5050* (JAUM, MO, TULV; estéril), *Devia et al. 5222* (JAUM, MO, TULV; estéril), *Devia et al. 5237* (JAUM, MO, TULV; estéril), *Devia et al. 5268* (JAUM, MO, TULV), *Devia et al. 5384* (JAUM, MO, TULV; estéril), *Devia et al. 5951* (JAUM, MO, TULV).

Faramea ampla C. M. Taylor, sp. nov. TIPO: Colombia. Valle: municipio Buenaventura, corregimiento Córdoba, vereda San Cipriano, Reserva Natural Río Escalerete, en la parcela permanente, cerca de la Parcela "E," 3°49′N, 76°52′W, 130 m, 22 sep. 1997, *W. Devia A., C. M. Taylor & J. Adarve 5601* (holótipo, TULV; isótipos, COL, JAUM, MO-4942001). Figura 4A, B.

Haec species a *Faramea calophylla* Standley fructu minore lateraliter compresso atque tubo corollino gracili distinguitur.

Arbustos o arbolitos hasta 6 m de alto, glabros. Hojas con láminas elípticas, 17.5–32 × 6.5–17 cm, con ápice acuminado a obtuso o redondeado y abruptamente cuspidado con acumen 10–15 mm de largo, con base cuneada a obtusa, cartáceas, con envés ligeramente pálido; venas secundarias 11–20 pares, con la vena submarginal sinuosa, desarrollada, en ambas superficies la costa prominente y la venación menor reticulada y promínula, en la haz las venas secundarias planas a ligeramente promínulas, en el envés promínulas; pecíolos 14–28 mm de largo; estípulas interpeciolares, caducas, porción interpeciolar deltoide, 8–15 mm de largo, brevemente aristada. Inflorescencias terminales, paniculadas, glabras, pedúnculos 5.5–11 cm de largo, panículas redondeadas, 10–12 × 12–18 cm, brácteas reducidas, pedicelos 2–5 mm de largo en címulas umbeliforme de 3–7; flores con limbo calicino 0.3–0.5 mm de largo, denticulado; corola en botón hipocrateriforme, azul, glabra, tubo ca. 6 mm de largo, lobos ca. 4 mm de largo. Frutos oblatos, algo aplanados lateralmente, ca. 13 × 16 mm, negro-azules, jugosos.

Distribución, habitat y fenología. En bosque pluvial a 50–180 m, en la costa pacífica del Chocó y el Valle del Cauca en Colombia. Colectada con flores en septiembre y diciembre, con frutos en febrero, septiembre y diciembre.

Esta nueva especie es similar a *Faramea calophylla* Standley, que se distingue por los frutos generalmente mas largos, no o casi no aplanados lateralmente y aparentemente coriáceos en lugar de jugosos y los tubos corolinos mas gruesos. El epiteto se refiere a las hojas por lo general relativamente grandes. Los frutos tienen un sabor insípido excepto un poco dulce (Taylor, obs. pers.).

Parátipos. COLOMBIA. **Chocó:** hills near highest point of Bagado–Certegui trail, 5°25′N, 76°28′W, *Juncosa 1545* (JAUM, MO); confluence of río Valle and río Mutata, *Warner 169* (MO). **Valle:** municipio Buenaventura, along the road between Buenaventura–Málaga at Km 51.3, 4°09′N, 77°11′W, *Croat & Watt 70347* (MO); municipio Buenaventura, corregimiento Córdoba, vereda San Cipriano, Reserva Natural Río Escalerete, en la parcela permanente, 3°49′N, 76°52′W, *Devia et al. 5598* (JAUM, MO, TULV); municipio Buenaventura, Bajo Calima region, N of Buenaventura, Cartón de Colombia concession, reserved area on lower Río San Juan below mouth of Río Calima, 4°10′N, 77°25′W, *Gentry 35473* (MO).

Faramea calimana C. M. Taylor, sp. nov. TIPO: Colombia. Valle: municipio Buenaventura, Bajo Calima, ca. 15 km N of Buenaventura, Cartón de Colombia Concession, Dindo area, 03°59′N, 77°02′W, 50 m, 28 mar. 1986, *A. Gentry, E. Zardini, M. Monsalve B. & J. D. Caicedo 53727* (holótipo, CUVC; isótipo, MO-3393526). Figura 2B.

Haec species a *Faramea calophylla* Standley corollae tubo lobulis breviore atque foliorum venatione tertiaria quaternariaque vix manifesta distinguitur.

Arbustos o arbolitos hasta 8 m de alto, glabros. Hojas con láminas elípticas a elíptico-oblongas, 10–23.5 × 3.5–9.5 cm, con ápice obtuso a redondeado y abruptamente cuspidado con acumen 7–15 mm de largo, con base aguda a cuneada o algo obtusa, cartáceas, con envés ligeramente pálido; venas secundarias 9–14 pares, con la vena submarginal sinuosa, desarrollada, en ambas superficies la costa promínula, las venas secundarias planas o ligeramente promínulas y la venación menor no evidente o las venas intersecundarias evidentes, delgadas y con unas vénulas transversales; pecíolos 3–20 mm de largo; estípulas tubulares, caducas, porción interpeciolar 10–13 mm de largo, con una parte libre triangular, aristada con arista 4–6 mm de largo. Inflorescencias terminales, paniculadas, glabras, pedúnculos 3–7 cm de largo, panículas triangulares a redondeadas, 5–10 × 6–14 cm, brácteas reducidas, pedicelos 5–17 mm de largo en címulas de 2–3; flores con limbo calicino 0.8–1 mm de largo, truncado a denticulado; corola hipocrateriforme, blanca a azul, glabra, tubo 8–9 mm de largo, lobos 15–20 mm de largo. Frutos no observados.

Distribución, habitat y fenología. En bosque

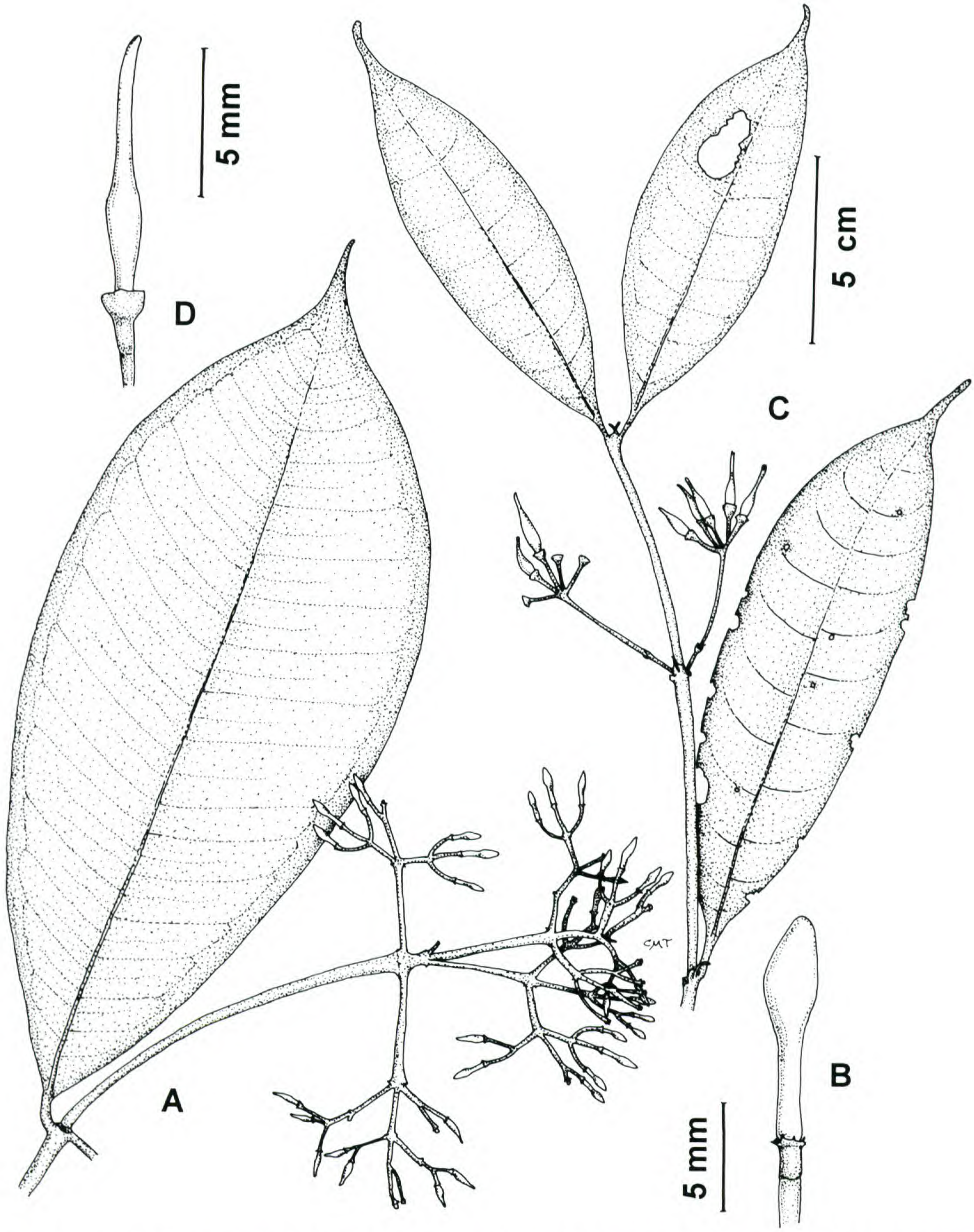

Figura 4. A, B, *Faramea ampla* C. M. Taylor; de *Warner 169*. —A. Ramita con inflorescencia. —B. Flor en botón. C, D, *Faramea monsalveae* C. M. Taylor; de *Gentry et al. 59594*. —C. Ramita con inflorescencia. —D. Flor en botón. A, C a la misma escala.

pluvial a 5–150 m, en la costa pacífica del Chocó y el Valle del Cauca en Colombia. Colectada con flores en febrero, marzo y abril.

Esta especie es similar a *Faramea calophylla*, especie simpátrica que tiene las corolas con el tubo igual o mas largo que los lobos y las hojas con las venas secundarias, intersecundarias y submarginales prominentes y la venación menor evidente, reticulada y promínula en ambas superficies. El epiteto se refiere a la región de donde viene el tipo.

Parátipos. COLOMBIA. **Chocó:** along road between Medellín and Quibdó, 5.5 km E of Tutunendo, 23.5 km E of Quibdó, 5°44′N, 76°29′W, *Croat 56217* (JAUM, MO); hoya del río San Juan, quebrada Taparal, afluente del río San Juan, alrededores de la comunidad indígena Waunaná de Taparalito, 4°12′N, 77°10′W, *Forero et al. 4276* (COL, MO); area of Baudó, on right side of Río Baudó, ca. 13 km upstream the estuary, near and on right back of Quebrada Carpio, *Fuchs & Zanella 21939* (MO). **Valle:** municipio de Buenaventura, Bajo Calima region, along road between Buenaventura and Málaga, on Carretera Hanz (lumber extraction road N of main Buenaventura–Málaga road), 6.5 km N of main road, 4°03′N, 77°03′W, *Croat 71126* (MO); municipio de Buenaventura, corregimiento San Isidro, reserva INDERENA-CONIF, *Devia & Prado 2606* (MO, TULV); municipio de Buenaventura, Cartón de Colombia Concession, km 22 via Málaga, frente Hans, *Devia 3061* (MO, TULV); municipio de Buenaventura, Bajo Calima, ca. 10 km due N of Buenaventura, Cartón de Colombia concession, 3°56′N, 77°08′W, *Gentry 35429* (MO; estéril), *35449* (MO; estéril), *Gentry et al. 40319* (MO; estéril); municipio de Buenaventura, Bajo Calima, ca. 15 km N of Buenaventura, Cartón de Colombia concession, Dindo area, 3°59′N, 77°02′W, *Gentry et al. 53635* (MO); municipio de Buenaventura, Bajo Calima, Juanchaco Palmeras area ca. 10 km NW of Buenaventura, 3°56′N, 77°08′W, *Gentry et al. 56877* (MO), *56932* (MO); municipio de Buenaventura, Concesión Pulpapel, bosque pluvial tropical, 3°55′N, 77°W, *Monsalve 667* (CUVC, MO); municipio de Buenaventura, Bajo Calima, Concesión Pulpapel, *van der Werff & Monsalve 9691* (MO).

Faramea monsalveae C. M. Taylor, sp. nov. TIPO: Colombia. Valle: municipio Buenaventura, Concesión Pulpapel, bosque pluvial tropical, 3°55′N, 77°W, 100 m, 30 ago. 1984, *M. Monsalve B. 274* (holótipo, CUVC; isótipos, JAUM, MO-3395866, NY). Figura 4C, D.

Haec species a *Faramea torquata* Mueller Argoviensis pedicellis longioribus, floribus paucioribus in cymulas umbelliformes quinquefloras dispositis atque corollae tubo lobulis longiore distinguitur.

Arbustos hasta 10 m de alto, glabros. Hojas con láminas elípticas o elíptico-oblongas, 10.5–20 × 4.5–8.5 cm, con ápice acuminado u obtuso a redondeado y cuspidado con acumen 1–2 cm de largo, con base obtusa a cuneada, cartáceas; venas secundarias 8–10 pares, no o ligeramente broquidódromas, en ambas superficies la costa y las venas secundarias promínulas y la venación menor reticulada y plana o con frecuencia ligeramente promínula; pecíolos 8–12 mm de largo; estípulas persistentes, triangulares a redondeadas, 2–5 mm de largo, costadas y aristadas, arista 3–5 mm de largo. Inflorescencias axilares y a veces terminales, 6–20-floras, pedúnculos 1 por axila o 3(–5) en el ápice del tallo, 3–5 cm de largo, articulados cerca de la base con brácteas estipulares reducidas, pedicelos 4–9 mm de largo en címulas umbeliformes 3–6-floras; flores en botón con limbo calicino 2–3 mm de largo, truncado; corola infundibuliforme, aparentemente blanca, glabra, con tubo ca. 6 mm de largo, lobos ca. 12 mm de largo, lanceolados, acuminados. Frutos subglobosos a ligeramente oblatos, ca. 12 × 15 mm, morados, con pedicelos hasta 19 mm de largo.

Distribución, habitat y fenología. En bosque pluvial a 50–100 m, en la costa pacífica del Chocó y el Valle del Cauca en Colombia. Colectada con flores en botón en diciembre, con frutos en enero, febrero, abril y agosto.

Esta especie es similar a *Faramea torquata* Mueller Argoviensis, especie amazónica que tiene los pedicelos mas cortos, las flores mas numerosas y la corola con el tubo mas largo que los lobos; y a *Faramea occidentalis* A. Richard, que tiene las hojas de textura mas fina, las inflorescencias usualmente terminales con las flores mas numerosas en címulas 3-floras y los pedúnculos no articulados. El epiteto es en honor a Miryam Monsalve, botánica colombiana quien ha colectado y estudiado extensivamente la flora de la región de Bajo Calima.

Parátipos. COLOMBIA. **Chocó:** trail to Tubadó, Quibdó–Tutuendo road 14 km NE of Quibdó, *Gentry & Rentería 24282* (HUA, MO; estéril); Quibdó–Tutunendo Road ca. 3 km W of Tutunendo, 5°46′N, 76°35′W, *Gentry et al. 30123* (JAUM, MO; estéril). **Valle:** municipio de Buenaventura, Bajo Calima, *Cabrera 504* (COL); municipio de Buenaventura, Bajo Calima Concession, ca. 20 km N of Buenaventura, ca. 300 m NW of "Dindo III," "Dindo IV" intersection on "Dindo IV," 3°59′N, 77°04′W, *Faber-Langendoen & Hurtado 1485* (MO; estéril); municipio de Buenaventura, Bajo Calima Concession, ca. 25 km NW of Buenaventura, ca. 9 km NW of San Isidro at intersection on "Canalete," near gate, 3°58′N, 77°08′W, *Faber-Langendoen & Hurtado 1658* (MO; estéril), *1758* (MO; estéril); municipio de Buenaventura, Bajo Calima, ca. 15 km N of Buenaventura, Cartón de Colombia Concession, 3°56′N, 77°08′W, *Gentry et al. 40273* (MO); municipio de Buenaventura, Bajo Calima, road to Juanchaco Palmeras, 3°55′N, 77°02′W, *Gentry et al. 47924* (MO); municipio de Buenaventura, Bajo Calima, Canalete area, Km 40 N of Buenaventura, W of San Isidro, 3°58′N, 77°00′W, *Gentry et al. 59594* (MO); municipio de Buenaventura, Concesión Pulpapel, 3°55′N, 77°W, *Monsalve 2064* (CUVC, MO).

Psychotria monsalveae C. M. Taylor, sp. nov. TIPO: Colombia. Valle: municipio de Buenaventura, along road from Buenaventura to Bajo Calima, ca. 4 km from Río Calima, near Km 14 marker (14 km from Cali–Buenaventura Hwy.), 3°56′N, 76°59′W, < 50 m, 21 Mar. 1984, *T. B. Croat 57527* (holótipo, MO-3194188; isótipo, CUVC). Figura 2C–E.

Haec species a congeneris stipulis lanceolatis interpetiolaribus caducis, foliorum nervo submarginali arcuato absentive, inflorescentiae axibus secundariis geminatis, floribus sessilibus vel brevipedicellatis in cymulas 3(–5)-

floras dispositis, limbo calycino 0.5–1 mm longo atque corollae fauce barbata et tubo ca. 2.5 mm longo distinguitur.

Arbustos hasta 1.3 m de alto, cuando secos con color pardo-rojizo o -castaño; ramitas glabras. Hojas con láminas elípticas a elíptico-oblongas, 8–21 × 2.5–8 cm, con ápice acuminado con acumen 1.2–2 cm de largo, con base aguda a cuneada, papiráceas, glabras o a veces pubérulas en el envés; venas secundarias 8–14 pares, con vena submarginal ausente o débil y conectándose en lazos, en la haz la costa promínula, las venas secundarias planas o a veces algo sulcadas y la venación menor plana, en el envés la costa y las venas secundarias prominentes y la venación menor promínula; pecíolos 8–20 mm de largo, glabros; estípulas caducas, lanceoladas, 6–15 mm de largo, agudas, enteras o cilioladas, con la costa engrosada y usualmente formando un triángulo engrosado en la base. Inflorescencias terminales, paniculadas, pubérulas, pedúnculos ca. 2.5 cm de largo, panículas corimbiformes a anchamente piramidales, ca. 4.5 × 6 cm, ejes secundarios 2 por nudo, brácteas lineares, hasta 1 mm de largo, pedicelos hasta 0.5 mm de largo; flores sésiles a brevipediceladas en címulas de 3(–5); hipanto ca. 1 mm de largo, puberulento; limbo calicino 0.5–1 mm de largo, dentado; corola infundibuliforme, blanca, externamente glabra, barbada en la garganta, tubo ca. 2.5 mm de largo, 1.2–1.5 mm de diám. cerca del medio, lobos angostamente triangulares, ca. 2 mm de largo, agudos; anteras ca. 1 mm de largo, exsertas sobre filamentos pubérulos; estigmas ca. 1.2 mm de largo, exsertos. Fruto no observado.

Distribución, habitat y fenología. En bosque pluvial a ca. 50 m, conocida solo de la región del tipo en la costa pacífica del Valle del Cauca en Colombia. Colectada con flores en marzo.

Esta especie pertenece al subgenero *Psychotria*; se distingue de la otras especies de este grupo por las estípulas distintivas, lanceoladas, interpeciolares y caducas; las hojas con la vena submarginal ausente o débil y conectándose en lazos; las inflorescencias con los ejes secundarios en pares; las flores sésiles o brevipediceladas en címulas de 3(–5); el limbo calicino 0.5–1 mm de largo; y la corola barbada en la garganta y con el tubo ca. 2.5 mm de largo. Las flores tienen las anteras y los estigmas ambos exsertos y producidos al mismo nivel, entonces parecen ser homostilas, estado raro pero ya conocido de *Psychotria* subg. *Psychotria* en Panamá (Hamilton, 1989). Además las flores del tipo tienen las anteras ya abiertas pero los estigmas apretados y aparentemente todavía jóvenes, un arreglo que sugiere que las flores son protándras. El epiteto también es en honor a Miryam Monsalve.

Parátipos. COLOMBIA. **Valle:** municipio de Buenaventura, Bajo Calima, ca. 15 km N of Buenaventura, Cartón de Colombia Concession, 3°56′N, 77°08′W, *Gentry et al. 40327* (CUVC, JAUM, MO); municipio de Buenaventura, Bajo Calima, ca. 15 km NW of Buenaventura, 18-year-old regeneration (Standl 2, Plot 3), behind Pulpapel camp, 3°59′N, 77°05′W, *Gentry et al. 56830* (CUVC, MO; estéril), *Gentry et al. 56834* (CUVC, MO; estéril).

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Nomenclator of Hawaiian *Sicyos* (Cucurbitaceae)

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ABSTRACT. In 1987 Harold St. John published 69 names in Hawaiian Cucurbitaceae in four short papers. The nomenclature is analyzed, and the complete nomenclature of the Hawaiian species of *Sicyos* is presented, including 105 names. Names described by St. John in *Sicyos* and the segregate genus *Cladocarpa* were incorporated by Telford in his 1990 treatment, but those names described in the segregate genera *Sarx* (1 name) and *Sicyocarya* (14 names) were not treated and are here placed in Telford's classification. Five of the taxa described by St. John in 1987 were recognized in Telford's taxonomy (*Cladocarpa herbstii* [= *Sicyos herbstii*], *Sicyos hillebrandii* var. *anunu* [= *S. anunu*], *S. erostratus*, *S. waimanaloensis*, and *Sicyocarya lanceoloidea* [as sp. A = *Sicyos lanceoloideus*]). Two of these were transferred to *Sicyos* by Telford, and one of them is here transferred to *Sicyos* [*Sicyocarya lanceoloidea*]. All of the other taxa described by St. John are placed in the synonymy of other species. Five of the names were not validly published (*Cladocarpa kawelaensis*, *Sicyocarya cruralis*, *Sicyocarya hawaiiensis*, *Sicyos erostratus* var. *kealiaensis*, and *Sicyos microcarpus* var. *kealiaensis*).

After the *Manual of the Flowering Plants of Hawai'i* (Wagner et al., 1990) was sent to the publisher, St. John published a hurried series of papers, cited in Wagner et al. (1990), in which he published about 880 manuscript names that he had accumulated over his entire career of studying the Hawaiian flora. Most of the names were validly published, but some were invalid or illegitimate. Over a period of about 30 years, he had developed lengthy manuscripts with accompanying detailed illustrations for a number of genera in a style similar to his treatment of O'ahu *Cyrtandra* (St. John, 1966). Few of them were ever completed and even fewer published. When the Wagner et al. (1990) flora manuscript was in the final stages of being readied for the publisher, St. John published just the new taxa and combinations from all of these manuscripts in *Phytologia* and privately in a series of papers that provided little more than a brief Latin diagnosis and an abbreviated mention of the type. Not only were the treatments of these numerous new taxa extremely brief, they were done without rechecking specimens (unpublished obs. by WLW). This led to many errors in citation of specimens, reusing names in the same genus (often even in the same paper), and reusing the same specimen as the type of more than one name. More importantly, he did not incorporate the taxa in a carefully evaluated taxonomic system. Now, after nearly 10 years, most of the approximately 880 names (including combinations) have been analyzed. St. John names in Campanulaceae published in 1987 and 1988 have been studied by T. Lammers (see Lammers, 1998, and papers cited therein).

This is the second of a series of papers analyzing the names published in 1987 and 1988 by St. John, in which the nomenclature is evaluated and the taxa incorporated in a current classification. Additional papers in this series have already dealt or will in the future deal with names in *Phyllostegia* (Wagner, 1999), *Stenogyne* (both Lamiaceae), and *Cyrtandra* (Gesneriaceae) and the special problems of the invalid and illegitimate names.

Although all names for Hawaiian angiosperms published through 1986 and a few from 1987 were included by Wagner et al. (1990) in the *Manual of the Flowering Plants of Hawai'i*, a rigorous assessment of them has never been done. In 1983, as part of the Hawaiian Flora Project at the Bishop Museum, a Hawaiian nomenclatural database was initiated. It included bibliographic and type information, and current classification. Many of the specialists contributing treatments to the *Manual* also completed database record forms for names based on Hawaiian specimens. Aspects of the project currently being developed include a database intended for WWW publication, a book, and several papers on specific problematic groups. In analyzing the nomenclature for the genus *Sicyos* (Cucurbitaceae), a number of problems were discovered. These included names not validly published or illegitimate, errors in original publications, typification problems, and the incorrect placement of one name (*Sicyos microcarpus* var. *kealiaensis*) in synonymy in the *Manual* treatment of Telford (1990). We here present a complete nomenclator of Hawaiian *Sicyos*,

including a number of not validly published names. One new combination by Wagner and Herbst is provided for an uncommon species from northern Kaua'i and the Wai'anae Mountains, O'ahu, which was treated as "species A" in Telford's (1990) treatment. Telford provided nomenclatural forms for most of the names published through 1986 as part of his contribution to the Hawaiian Flora Project. We have confirmed and added to this information, analyzed the 69 names published in 1987 by St. John (1987a, 1987b, 1987c, 1987d), and added the 3 combinations made by Telford (1989). Names described by St. John in *Sicyos* and the segregate genus *Cladocarpa* were incorporated by Telford in his 1990 treatment, but those described in the segregate genera *Sarx* (one name) and *Sicyocarya* (14 names) were not and are here placed in the classification. Five of the taxa described by St. John in 1987 were recognized in Telford's taxonomy (*Cladocarpa herbstii* [= *Sicyos herbstii*], *Sicyos hillebrandii* var. *anunu* [= *S. anunu*], *S. erostratus*, *S. waimanaloensis*, and *Sicyocarya lanceoloidea* [as sp. A = *Sicyos lanceoloidea*]). Two of these were transferred to *Sicyos* by Telford, and one of them is here transferred to *Sicyos* [*Sicyocarya lanceoloidea*]. All of the other taxa described by St. John are placed in the synonymy of other species. In cases where we have not seen any material of a taxon, the disposition is based on Telford's (1990) placement of the name. There are a number of names for which the holotype is missing or destroyed, a couple of situations where no holotype was designated, and others where no original material can be located. We have refrained from designation of lectotypes or neotypes in all of these cases following recommendation 9A of the ICBN (Greuter et al., 1994). As stability of accepted names does not seem in question, we prefer to leave these selections to those engaged in detailed revision of the genus. Five of the names were not validly published. Since the emphasis of this paper is nomenclature rather than taxonomy, the accepted names are arranged alphabetically. All of the indigenous Hawaiian species of the four segregate genera described by St. John (*Cladocarpa* (H. St. John) H. St. John, *Sarx* H. St. John, *Sicyocarya* H. St. John, *Skottsbergiliana* H. St. John) are placed in the genus *Sicyos* as recommended by Jeffrey (1978) and followed by Telford (1990).

Nomenclature

1. Sicyos alba (H. St. John) Telford, Phytologia 67: 210. 1989. *Sarx alba* H. St. John, Bot. Jahrb. Syst. 99: 493. 1978. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Kulani, Sep. 1974, *W. C. Gagné 698* (holotype, BISH-502382; isotypes, BISH [2]).

2. Sicyos anunu (H. St. John) Telford, Phytologia 67: 211. 1989. *Sicyos hillebrandii* H. St. John var. *anunu* H. St. John, Phytologia 63: 187. 1987. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Kapapala, Ka'u, 4–7 Aug. 1911, *C. N. Forbes 400.H* (holotype, BISH-92745).

Sicyos hillebrandii var. *douglasii* H. St. John, Phytologia 63: 187. 1987. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: N slope of Mauna Kea, near where David Douglas was murdered, 23 Aug. 1949, *O. Degener & A. Greenwell 21364* (holotype, BISH-522868; isotype, NY).

Sicyos hillebrandii var. *lanaiensis* H. St. John, Phytologia 63: 188. 1987. TYPE: Hawaiian Islands [U.S.A.]. Lana'i: Kamoa, 1740 ft., 16 May 1929, *G. C. Munro 417* (holotype, BISH-633922; isotypes, PTBG [3]).

3. Sicyos cucumerinus A. Gray, Proc. Amer. Acad. Arts 3: 54. 1853; U.S. Expl. Exped., Phan. 652. 1854. *Sicyocarya cucumerina* (A. Gray) H. St. John, Phytologia 38: 407. 1978. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: [Mauna Kea, upper part of the forests], 1840, *U.S. Expl. Exped. s.n.* (holotype, US-48017). The material used by A. Gray in descriptions of *S. cucumerinus* and the unnamed β and γ varieties was mounted on two sheets. Gray's species description is of the sheet taken as the holotype, with short descriptions of the two additional taxa given afterward. They are both mounted on US-48018. The specimen of variety β is *S. alba* (St. John) Telford and that of variety γ is a lobed-leaf form of *S. cucumerinus*.

Sicyos cucumerinus var. *triangulata* Cogniaux, Monogr. Phan. 3: 898. 1881. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: [East Maui, Haleakala], 27 Jan.–12 Feb. 1870, *H. Wawra 1916* (syntype, W [presumably destroyed]); *H. Wawra 1619* (syntype, W [presumably destroyed]). Locality taken from Wawra (1873). Cogniaux cited *H. Wawra 1619* and *1916*; however, Wawra (1873) cited only the latter collection, and thus we have no information about the former. Present disposition based on locality and description.

Sarx kauaiensis H. St. John, Bot. Jahrb. Syst. 109: 257. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: along Wai'alae Stream between 1st and 2nd bend above Wai'alae Cabin, 3600 ft., 10 Sep. 1980, *K. M. Nagata 2141* (holotype, BISH-520191).

Sicyocarya mauiensis H. St. John, Phytologia 64: 53. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: [East Maui], Haleakala Crater, Kaupo Gap, second cove S of Waikeke'ehia, in grove on lower part of N-facing slope, 6000 ft., 27 Aug. 1945, *H.*

St. John & A. L. Mitchell 21198 (holotype, BISH-521561; isotypes, BISH [2]).

Sicyocarya molokaiensis H. St. John, Phytologia 64: 53. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Kahua'awi Gulch, partly shaded thicket near stream, 4 June 1928, *O. Degener 18398* (holotype, NY-58603).

Sicyocarya saltuaria H. St. John, Phytologia 64: 54. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: South Kona, Honaunau Forest Reserve, 3000 ft., Nov. 1957, *L. W. Bryan s.n.* (holotype, BISH-92762; isotype, BISH).

Sicyocarya umbellata H. St. John, Phytologia 64: 54. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: [East Maui], Hana Dist., along ridge in central Kipahulu Valley, 3580 ft., 22 July 1980, *P. K. Higashino & R. A. Holt 9412* (holotype, BISH-463291).

4. Sicyos erostratus H. St. John, Phytologia 63: 187. 1987. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Onini Gulch, 2200 ft., 21 Jan. 1973, *L. E. Bishop 1714* (holotype, BISH-519993).

Sicyos erostratus var. *herbstii* H. St. John, Phytologia 63: 187. 1987. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Kalamalua, past Homalani Cemetery, on jeep road to Moloka'i Forest Reserve, on S side of road, 600 ft., 3 Apr. 1973, *D. Herbst 2944* (holotype, BISH-519978; isotypes, BISH [3], US).

Sicyos erostratus var. *paucipilosus* H. St. John, Phytologia 63: 187. 1987. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Onini Gulch, 2300 ft., 21 Jan. 1973, *L. E. Bishop 1713* (holotype, BISH-519979).

5. Sicyos herbstii (H. St. John) Telford, Phytologia 67: 210. 1989. *Cladocarpa herbstii* H. St. John, Phytologia 63: 185. 1987. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Waimea Dist., Queen's Pond area of Barking Sands, 10 ft., 26 Feb. 1976, *D. Herbst & S. Ishikawa 5691* (holotype, BISH-520171 and -520396; isotypes, BISH [4], US).

Cladocarpa julesii H. St. John, Phytologia 63: 185. 1987. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: *J. Rémy 542* (holotype, P not seen).

Cladocarpa pauciramosa H. St. John, Phytologia 63: 186. 1987. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Polihale Cliffs, s.d., *C. Christensen 326* (holotype, BISH-520196; isotypes, BISH [3]).

Sicyocarya lebishopii H. St. John, Phytologia 64: 53. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Waimea Canyon, Koaie Branch, on floor of gulch, 2050 ft., 3 June 1972, *L. E. Bishop 1316* (holotype, BISH-521557; isotypes, BISH [2]).

6. Sicyos hillebrandii H. St. John, Occas. Pap. Bernice P. Bishop Mus. 10(12): 7. 1934. *Sicyos laciniatus* Hillebrand, Fl. Hawaiian Isl. 138. 1888. Nom. illeg., non L. (1753). TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, Kula, 1851–1871, *W. Hillebrand s.n.* (holotype, B [presumably destroyed]; isotypes, BISH, K). The BISH sheet has the label printed by C. N. Forbes for Lydgate's herbarium stating the collectors as Hillebrand and Lydgate, but Hillebrand did not give Lydgate as one of the collectors.

7. Sicyos hispidus Hillebrand, Fl. Hawaiian Isl. 136. 1888. *Cladocarpa hispida* (Hillebrand) H. St. John, Bot. Jahrb. Syst. 99: 491. 1978. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, Kula, 1851–1871, *W. Hillebrand s.n.* (holotype, B [presumably destroyed, photo BISH]; isotypes, BISH, K not seen). The BISH sheet has the label printed by C. N. Forbes for Lydgate's herbarium stating the collectors as Hillebrand and Lydgate, but Hillebrand did not give Lydgate as one of the collectors.

Cladocarpa capitata H. St. John, Phytologia 63: 185. 1987. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: North Kona Dist., land of Pu'u Anahulu, Pu'u Wa'awa'a Ranch at base of Pu'u Anahulu Ridge near Mamalahoa Hwy., 2100 ft., 26 June 1975, *D. Herbst & S. Ishikawa 5393* (holotype, BISH-520662; isotypes, BISH [2]).

Cladocarpa discoidea H. St. John, Phytologia 63: 185. 1987. TYPE: Hawaiian Islands [U.S.A.]. Maui: West Maui, Pohakea Gulch, arid rocky valley, 11 July 1927, *O. Degener 9893* (holotype, NY-58605). Degener used this collection number more than once; US sheet of *O. Degener 9893* is *Wahlenbergia gracilis*, collected 5 May 1928.

Cladocarpa harrisonae H. St. John, Phytologia 63: 185. 1987. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Kulaupapa, 1974, *B. Harrison s.n.* (holotype, BISH-520193; isotypes, BISH [2]).

Cladocarpa lanaiensis H. St. John, Phytologia 63: 186. 1987. TYPE: Hawaiian Islands [U.S.A.]. Lana'i: Maunalei, *J. Jacobi 1979* (holotype, BISH not seen). Holotype missing at least since October 1987. The brief diagnosis by St. John suggests *Sicyos hispidus*; thus this disposition is tentative.

Cladocarpa munroi H. St. John, Phytologia 63: 186. 1987. TYPE: Hawaiian Islands [U.S.A.]. Lana'i: Ka'ena, 25 Apr. 1914, *G. C. Munro 87* (holotype, BISH-92762).

Cladocarpa umbellata H. St. John, Phytologia 63: 186. 1987. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: belt road between Huehue and Pu'u Wa'awa'a, North Kona, 1900 ft., 9 Nov. 1950, *W. H. Hatheway 509* (holotype, BISH-92743; isotype, BISH).

Cladocarpa waimeaensis H. St. John, Phytologia 63: 186. 1987. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: 20 mi. along main road from Waimea toward Kona, 18 Aug. 1926, *O. Degener 17416* (holotype, NY-58613). St. John did not annotate this sheet as the holotype, but it is the only collection with this number from this locality at NY. Degener distributed another collection (type of *Sicyos waimanaloensis* H. St. John) from a different locality and date under the same number.

8. Sicyos lanceoloideus (H. St. John) W. L. Wagner & D. R. Herbst, comb. nov. Basionym: *Sicyocarya lanceoloidea* H. St. John, Phytologia 64: 52. 1987. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Koke'e on left side of Waimea Canyon, on side of gully, 7 July 1917, *C. N. Forbes 776.K* (holotype, BISH-520175; isotypes, BISH [4]).

Sicyos cucumerinus A. Gray var. *tripartita* Cogniaux, Monogr. Phan. 3: 898. 1881. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Halemanu, [23 Feb.–29 Mar. 1870], *H. Wawra 2091* (syntype, W [presumably destroyed]); Waimea, 2000–3000 ft., 1864–1865, *H. Mann & W. T. Brigham 604* (syntype, BISH [2]). Present disposition based on H. Mann & W. T. Brigham syntype.

Sicyocarya kaalaensis H. St. John, Phytologia 64: 51. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Wai'anae Mts., Mt. Ka'ala, Wai'anae Uka, 2600 ft., 18 Apr. 1948, *H. St. John 23365* (holotype, BISH-519980; isotypes, BISH [8]).

Sicyocarya kalalauensis H. St. John, Phytologia 64: 52. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Kalalau Valley, 18 July 1909, *C. N. Forbes & C. H. Dole 59.K* (holotype, BISH-92766; isotype, US).

Sicyocarya kauaiensis H. St. John, Phytologia 64: 52. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Koke'e Camp, 25 June 1926, *O. Degener 18041* (holotype, NY-19546). St. John's paper indicated that all types are at BISH unless otherwise noted, but there is no *Degener 18041* collection at BISH and St. John did not indicate any other institution for the type. The NY sheet is the probable holotype since it is the only sheet of this collection we have seen, and the first set of Degener's collections are deposited at NY or BISH. Perhaps St. John intended to add "NY" to indicate that the type was there.

Sicyocarya obatae H. St. John, Phytologia 64: 53. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Wai'anae Mts., Wai'anae Kai-Makaha ridge, dry native forest, 2250 ft., 4 Nov. 1973, *W. C. Gagné, J. Obata & D. Palmer 682* (holotype, BISH-521564; isotypes, BISH [2], PTBG, US).

9. Sicyos lasiocephalus Skottsberg, Acta Horti Gothob. 10: 184. 1936. *Skottsbergiliana lasiocephala* (Skottsberg) H. St. John, Pacific Sci. 28: 458. 1974. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: N Kona, along road near Huehue, on 'a'a lava, 26 Sep. 1926, *C. Skottsberg 1947* (holotype, GB [on 2 sheets] not seen; isotypes, BISH). St. John's lectotypification (1974 [1975]) was superfluous. Skottsberg mentioned three collections in the protologue, but segregated his number 1947 in a separate paragraph and compared it to other collections. He referred to "the type specimen" in the next paragraph, and wrote "type" on the collection label.

Skottsbergiliana partita H. St. John, Pacific Sci. 28: 460. 1974. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: 20 mi. from Waimea toward Kona, 'a'a desert along road, 18 Aug. 1926, *O. Degener 9896* (holotype, GB not seen; isotype, NY). St. John apparently considered *O. Degener 9896* to be a mixed collection, as he added an "A" to the collection number of a sheet at NY and annotated it as *Skottsbergiliana lasiocephala* at the same time he annotated the other NY sheet as an isotype of *S. partita*.

10. Sicyos macrophyllus A. Gray, Proc. Amer. Acad. Arts 3: 54. 1853; U.S. Expl. Exped., Phan. 651. 1854. *Sicyocarya macrophylla* (A. Gray) H. St. John, Phytologia 38: 407. 1978. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: [in the forests of Mauna Kea, toward their upper margin], 1840, *U.S. Expl. Exped. s.n.* (holotype, US-48022).

Sicyocarya beccifer H. St. John, Phytologia 64: 51. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: North Hilo Dist., Hilo Forest Reserve, E slope of Mauna Kea, makai of Keanakohi Rd., 5880 ft., 17 Nov. 1977, *F. R. Warshauer 1535* (holotype, BISH-463288).

Sicyocarya kilaueaensis H. St. John, Phytologia 64: 52. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Kilauea Volcano; mile 23, wet forest, Aug. 1918, *J. F. Rock 16006* (holotype, BISH-520200; isotypes, BISH [4]).

Sicyocarya kipahuluensis H. St. John, Phytologia 64: 52. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: [East Maui], Kipahulu Stream, 22 Nov. 1919, *C. N. Forbes 1709.M* (holotype, BISH-92763; isotype, BISH).

Sicyocarya konaensis H. St. John, Phytologia 64: 52. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Kona, McCandless forests, 2500 ft., Feb. 1958, *J. F. Rock 26018* (holotype, BISH-520402; isotypes, BISH [2]).

Sicyocarya puberula H. St. John, Phytologia 64: 54. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: eastern slopes of Mauna Ke'a, near David Douglas Historical Monument, ahupua'a of Laupahoehoe, 5800 ft., 29 Nov. 1969, *C. H. Lamoureux 4382* (holotype, BISH-520676; isotypes, BISH, CBG, US). Specimen label indicates liquid-preserved flowers and fruits at Univ. of Hawaii Botany Dept.

Sicyocarya rockii H. St. John, Phytologia 64: 54. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: North Kona Dist., Pu'u Wa'awa'a Ranch (Waihou/Waimea Paddock), 3000 ft., 18 July 1975, *D. Herbst, S. Montgomery & G. Spence 5433* (holotype, BISH-519989; isotypes, BISH [3]). Holotype does not have Montgomery named as a collector, but isotypes do, and Herbst (pers. comm. 1997) verified that Montgomery was one of the collectors.

11. Sicyos maximowiczii Cogniaux, in DC., Monogr. phan. 3: 895. 1881. *Cladocarpa maximowiczii* (Cogniaux) H. St. John, Bot. Jahrb. Syst. 99: 491. 1978. TYPE: Hawaiian Islands

[U.S.A.]. O'ahu: 1826–1829, *G. Kastalsky s.n.* (holotype, LE not seen).

Sicyos niihauensis H. St. John, Pacific Sci. 13: 175. 1959. *Cladocarpa niihauensis* (H. St. John) H. St. John, Bot. Jahrb. Syst. 99: 491. 1978. TYPE: Hawaiian Islands [U.S.A.]. Ni'ihau: 1 mi. W of Ki'i, 50 ft., 29 Mar. 1949, *H. St. John 23567* (holotype, BISH-501834, -501835, -501836, and -501837; isotypes, BISH [2], PTBG [4]).

Sicyos atollensis H. St. John, Pacific Sci. 24: 446. 1970. *Cladocarpa atollensis* (H. St. John) H. St. John, Bot. Jahrb. Syst. 99: 491. 1978. TYPE: Northwestern Hawaiian Islands [U.S.A.]. Ocean Island [Kure Atoll]: *Scaevola* "islands" in central plain and nearby, 4 m, 18 Apr. 1923, *E. L. Caum 13* (holotype, BISH-501816; isotypes, BISH, NY, W not seen).

Sicyos caumii H. St. John, Pacific Sci. 24: 448. 1970. *Cladocarpa caumii* (H. St. John) H. St. John, Bot. Jahrb. Syst. 99: 491. 1978. TYPE: Northwestern Hawaiian Islands [U.S.A.]. Pearl and Hermes Reef, Seal Island, eastern half of higher part of island, 3 m, 27 Apr. 1923, *E. L. Caum 53* (holotype, BISH-501818; isotype, BISH).

Sicyos lamoureuxii H. St. John, Pacific Sci. 24: 451. 1970. *Cladocarpa lamoureuxii* (H. St. John) H. St. John, Bot. Jahrb. Syst. 99: 491. 1978. TYPE: Kure, near end of runway on W side, 12 Sep. 1961, *C. H. Lamoureux 1901* (holotype, BISH-501822; isotype, BISH). St. John cited "nos. 1899, 1900, 1902–3 are evidently isotypes (BISH)"; Lamoureux (pers. comm. 1998) indicated he assigned different numbers when specimens came from different plants, thus we do not consider these to be isotypes, but rather paratypes.

Cladocarpa lehuaensis H. St. John, Phytologia 63: 186. 1987. TYPE: Hawaiian Islands [U.S.A.]. Lehua: 4 May 1965, *C. R. Long 3017* (*coll. W. King & V. Hoemon*) (holotype, HAW not seen; isotype, BISH). Actually, the sheet at BISH here listed as an isotype may in fact be the holotype. G. Carr (pers. comm. 1998) indicated that there is no sheet of this collection extant at HAW, and that many of the Long collections were given to BISH.

12. Sicyos pachycarpus Hooker & Arnott, Bot. Beechey Voy. 83. 1832. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Diamond Hill [Head], 1826–1827, *A. Collie s.n.* (lectotype, designated by Telford (1989), K not seen). The K sheet was a mixed collection of two elements: one of *Sicyos waimanaloensis*, annotated by St. John as lectotype, but which was never published (ined.); and the other the same taxon as the type of *Sicyos microcarpus* H. Mann selected by Telford as the lectotype. The two elements have been remounted on separate sheets.

Sicyos microcarpus H. Mann, Proc. Amer. Acad. Arts 7: 167. 1867. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: 1851–1855, *J. Rémy 541* (holotype, A not seen; isotypes, BR not seen, P).

Sicyos remyanus Cogniaux, in DC., Monogr. phan. 3: 898. 1881. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: 1851–1855, *J. Rémy 540* (holotype, P not seen; isotypes, BR not seen, P [3] not seen).

Sicyos laysanensis H. St. John, Pacific Sci. 24: 440. 1970. *Sicyos microcarpus* subsp. et var. *laysanensis* (H. St. John) H. St. John, Phytologia 63: 190. 1987. TYPE: Hawaiian Islands [U.S.A.]. Laysan: May 1911, *W. A. Bryan A* (holotype, BISH-501827; isotype, BISH). Two other specimens, collected in April 1903, were annotated as "isotype" by St. John, but are not isotypes.

Sicyos nihoaensis H. St. John, Pacific Sci. 24: 443. 1970. TYPE: Hawaiian Islands [U.S.A.]. Nihoa: W slope of Tanager Peak, 200 m, 12 July 1924, *E. Christophersen & T. Dranga 9* (holotype, BISH-501829; isotypes, BISH, US).

Sicyos microcarpus var. *ewaensis* H. St. John, Phytologia 63: 190. 1987. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: W side of coral plains at Ewa, near Barber's Point, ocean side of Malakole Rd. near Camp Malakole Military Res., 10 ft., 21 June 1978, *K. M. Nagata & B. Kimura 1656* (holotype, BISH-522860; isotype, BISH).

Sicyos microcarpus var. *forbesii* H. St. John, Phytologia 63: 188. 1987. TYPE: Hawaiian Islands [U.S.A.]. Maui: West Maui, Maunaho'oma, May 1910, *C. N. Forbes 11.M* (holotype, BISH-92753).

Sicyos microcarpus var. *haleakalaensis* H. St. John, Phytologia 63: 191. 1987. TYPE: Hawaiian Islands [U.S.A.]. Maui: [East Maui], Wai'opai, *C. N. Forbes 1851.M* (holotype, BISH not seen). Holotype missing at least since October 1987.

Sicyos microcarpus var. *kalaupapaensis* H. St. John, Phytologia 63: 188. 1987. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Kalaupapa beach, 24 May 1918, *J. F. Rock 14061* (holotype, BISH-519999; isotypes, BISH [2]).

Sicyos microcarpus var. *kamoaensis* H. St. John, Phytologia 63: 189. 1987. TYPE: Hawaiian Islands [U.S.A.]. Lana'i: Kamoa, 1740 ft., 16 May 1929, *G. C. Munro 418* (holotype, BISH-91960; isotypes, BISH [3]).

Sicyos microcarpus subsp. *kanepuuensis* H. St. John, Phytologia 63: 189. 1987. TYPE: Hawaiian Islands [U.S.A.]. Lana'i: Kanepu'u, 28 May 1927, *G. C. Munro 10* (holotype, BISH-190149; isotype, BISH).

Sicyos microcarpus var. *kauensis* H. St. John, Phytologia 63: 191. 1987. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Ka'u, on lava, Apr. 1911, *J. F. Rock s.n.* (holotype, BISH-190169).

Sicyos microcarpus var. *kilaueaensis* H. St. John, Phytologia 63: 188. 1987. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: Apua, Hawai'i [Volcanoes] National Park, on slope of pali, 2000 ft., 10 May 1943, *G. O. Fagerlund & A. M. Mitchell 544* (holotype, BISH-519906).

Sicyos microcarpus var. *koeleensis* H. St. John, Phytologia 63: 190. 1987. TYPE: Hawaiian Islands [U.S.A.]. Lana'i: mts. near Ko'ele, June 1913, *C. N. Forbes 95.L* (holotype, BISH-519997; isotypes, BISH [4]).

Sicyos microcarpus var. *koloaensis* H. St. John, Phytologia 63: 191. 1987. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Koloa Dist., ahupua'a of Koloa, 1 mi. W of Poipu Beach Park, 10 ft., 13 Apr. 1963, *C. H. Lamoureux 2346* (holotype, BISH-520014; isotypes, BISH [3]).

Sicyos microcarpus subsp. et var. *lanaiensis* H. St. John, Phytologia 63: 189. 1987. TYPE: Hawaiian Islands [U.S.A.]. Lana'i: Kolulu, 24 Mar. 1916, *G. C. Munro*

535 (holotype, BISH-92754; isotypes, BISH [3]). Two of the isotypes have additional collection data, possibly written by Forbes, including a date of "3/29/16." This appears to be a misinterpretation of the original handwritten label on the holotype.

Sicyos microcarpus var. *meeboldii* H. St. John, Phytologia 63: 191. 1987. TYPE: Hawaiian Islands [U.S.A.]. Hawai'i: North Kona, Kaupulehu, 3 mi. E of Huehue, 2000 ft., 23 June 1948, *G. L. Webster & R. L. Wilbur 1837* (holotype, BISH-632025; isotype, TEX not seen). St. John erroneously published the collector number as *Webster 1537*, which is a specimen of *Phyllostegia grandiflora* collected on O'ahu.

Sicyos microcarpus var. *obovoideis* H. St. John, Phytologia 63: 191. 1987. TYPE: Hawaiian Islands [U.S.A.]. Maui: s.l., s.d., *H. F. Clay s.n.* (holotype, BISH-522864; isotype(s), BISH, PTBG, US). Although published by St. John as collected by Clay, the label clearly states: "Sent from Maui to H. F. Clay; given by him to Bishop Museum May 16, 1954." Published as "*obovoideis*," but St. John's handwriting on the specimen label is "*obovoideus*."

Sicyos microcarpus var. *oniniensis* H. St. John, Phytologia 63: 190. 1987. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Onini Gulch bottom, 2200 ft., 21 Jan. 1973, *L. E. Bishop 1690* (holotype, BISH-513075).

Sicyos microcarpus var. *paneensis* H. St. John, Phytologia 63: 188. 1987. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Kamokuiki Valley, between Pu'u Iki and Pu'u Kamaohanui, 12 Apr. 1933, *O. Degener 18035* (holotype, NY-58617; isotypes, NY [2]).

Sicyos microcarpus var. *pohakeaensis* H. St. John, Phytologia 63: 188. 1987. TYPE: Hawaiian Islands [U.S.A.]. Maui: West Maui, Pohakea Gulch, arid valley floor, 11 July 1927, *O. Degener 18400* (holotype, NY-58614).

Sicyos microcarpus subsp. *puberulus* H. St. John, Phytologia 63: 191. 1987. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Wai'anae, arid roadside near town, 10 Apr. 1932, *O. Degener 18391* (holotype, US-1862308; isotypes, NY [2]).

Sicyos microcarpus var. *trilobata* H. St. John, Phytologia 63: 190. 1987. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Makolelau Gulch, 760 m, 15 May 1973, *W. C. Gagné 676* (holotype, BISH-522869).

Sicyos microcarpus var. *woolfordii* H. St. John, Phytologia 63: 189. 1987. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: 'Ewa coral flats, 11 Mar. 1957, *H. A. Woolford s.n.* (holotype, BISH-522862; isotype, BISH).

Sicyos niger H. St. John, Phytologia 63: 192. 1987. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, Hana Dist., Nu'u, 10 ft., 28 Mar. 1971, *H. St. John 26771* (holotype, BISH-522866; isotypes, BISH [7], US).

Sicyocarya atrimaculata H. St. John, Phytologia 64: 51. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Maui: East Maui, below Haleakala Ranch pipeline, 3900 ft., 20 Feb. 1928, *G. C. Munro 801* (holotype, BISH-521555; isotype, BISH).

Sicyocarya rostrata H. St. John, Phytologia 64: 54. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Kaua'i: Waimea Dist., in Queen's Pond area of Barking Sands, 10 ft., 26 Feb. 1976, *D. Herbst & S. Ishikawa 5691A* (holotype, BISH-520406; isotype, BISH).

13. Sicyos semitonsus H. St. John, Pacific Sci. 24: 453. 1970. *Cladocarpa semitonsa* (H. St. John) H. St. John, Bot. Jahrb. Syst. 99: 491. 1978. TYPE: Hawaiian Islands [U.S.A.]. Laysan: NW end of lagoon in a flat area, 19 Sep. 1964, *C. R. Long 2370* (holotype, BISH-502486 and -502487). Original plate for illustration also mounted and in the collection (BISH). St. John cited "other collections with the same data, *Long 2365*, *2368*, and *2369* (Univ. Hawaii) are evidently duplicates and therefore isotypes." But they must be considered paratypes, since they have different collection numbers.

14. Sicyos waimanaloensis H. St. John, Phytologia 63: 192. 1987. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: talus SW of Waimanalo Landing, 10 Apr. 1936, *O. Degener 17416* (holotype, US-1864571; isotypes, BISH [2], NY [3]). Degener distributed another collection (type of *Cladocarpa waimeaensis* H. St. John, a synonym of *Sicyos hispidus*) from a different locality and date under the same number.

Sicyocarya kaenaensis H. St. John, Phytologia 64: 51. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Wai'anae Mts., Ka'ena Point, bluffs halfway between Pu'u Pueo and Pu'u Manini, 300 ft., 6 Apr. 1976, *G. D. Carr 898* (holotype, BISH-520399; isotypes, BISH [2]).

Sicyocarya kokocrateris H. St. John, Phytologia 64: 52. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Koko Crater, Maunalua, on crest of S rim, in thicket, 250 ft., 1 Apr. 1979, *H. St. John 26936* (holotype, BISH-521548; isotypes, BISH [2], US).

Sicyocarya paucifrugalis H. St. John, Phytologia 64: 53. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Moloka'i: Waiakuilani Gulch bottom, 2700 ft., 25 Jan. 1973, *L. E. Bishop & T. Pratt 1766* (holotype, BISH-521554).

Sicyocarya protrusa H. St. John, Phytologia 64: 54. 1987. Syn. nov. TYPE: Hawaiian Islands [U.S.A.]. Lana'i: Maunalei Gulch, Maunalei, 500 ft., 12 Apr. 1938, *H. St. John, A. J. Eames & E. Y. Hosaka 18818* (holotype, BISH-521551; isotypes, BISH [2]).

Invalidly Published Names

Cladocarpa kawelaensis H. St. John, Phytologia 63: 185. 1987. No type cited for this name (ICBN Article 37.3; Greuter et al., 1994). = *Sicyos hispidus*

Sicyocarya cruralis H. St. John, Phytologia 64: 51. 1987. *Sicyocarya hawaiiensis* H. St. John, Phytologia 64: 51. 1987. The same collection, *Rémy 539* (P), was cited as type of both names. Neither name is validly published under ICBN Art. 34.2 (Greuter et al., 1994). = *Sicyos macrophyllus*

Sicyos erostratus H. St. John var. *kealiaensis* H. St. John, Phytologia 63: 187. 1987. *Sicyos microcarpus* var. *kealiaensis* H. St. John, Phytologia 63: 189. 1987. The same collection, *W. C. Gagné 671* (BISH [2]), was cited as type of both names. Neither name is validly published under ICBN Art. 34.2 (Greuter et

al., 1994). Telford included *Sicyos erostratus* var. *kealiaensis* in *S. erostratus*; he placed *Sicyos microcarpus* var. *kealiaensis* in the synonomy of *S. pachycarpus*. = *Sicyos erostratus*

Excluded Name

Sicyos fauriei H. Léveillé, Repert. Spec. Nov. Regni Veg. 10: 150. 1911. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: Kaliki [Kalihi], Oct. 1909, *U. Faurie 877* (holotype, P not seen; isotype, BM not seen). The type of this name is a specimen of the common weed, *Momordica charantia* L. (see Lauener, 1980).

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Rediscovery and Assessment of *Stenogyne sherffii* Degener (Lamiaceae)

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ABSTRACT. *Stenogyne sherffii* O. Degener from the Ko'olau Mountains, O'ahu, Hawaiian Islands, was treated as synonymous with the more common species from the Wai'anae Mountains, *S. kaalae* Wawra, in the most recent revision of the genus by Weller and Sakai in 1990. A single population of about five plants of this entity was rediscovered in 1994. A plant was propagated from a stem cutting in the greenhouse at the University of California, Irvine. Comparison to plants of *S. kaalae* grown in the same greenhouse and herbarium material shows that the rare Ko'olau plants are distinct in several characters, especially subentire vs. serrate leaves. We here recognize this taxon as a subspecies of *S. kaalae* because of the clear species synapomorphy of very dark maroon corolla color and the geographical separation of the two taxa.

Stenogyne Bentham is an endemic Hawaiian genus of vines in the Lamiaceae consisting of 21 species (Weller & Sakai, 1990; Wagner & Weller, 1991), with greater diversity on younger than on older islands. Hawai'i (8 species) and Maui (9 species) have the greatest diversity, while lower diversity occurs on Moloka'i (3 species), Lana'i (2 species), O'ahu (2 species), and Kaua'i (3 species). The reduced lower corolla lip, exserted stamens, abundant nectar production, lack of floral odor, and long falcate corollas of some *Stenogyne* species provide circumstantial evidence for pollination of *Stenogyne* by honeycreepers (Weller & Sakai, 1990). In the Hawaiian genus *Phyllostegia* Bentham, with which *Stenogyne* and *Haplostachys* (A. Gray) Hillebrand share a common ancestor, the presence of a sweet floral fragrance among some species and the expanded lower corolla lip and predominant white coloration indicate pollination by insects (Weller & Sakai, 1990).

After the publication of the treatment of *Stenogyne* by Weller and Sakai (1990), J. Obata rediscovered a small population of the plant described by Degener (1943) as *S. sherffii* from the northern Ko'olau Mountains, O'ahu. Subsequently, we have propagated it from a stem cutting in the greenhouse at the University of California, Irvine. For comparative purposes we have also grown *S. kaalae* Wawra, which occurs at a number of localities in the Wai'anae Mountains, O'ahu (with a single collection made in 1852 from Nu'uanu Pali in the southern Ko'olau Mountains). The plants described as *Stenogyne sherffii* are closely allied to *S. kaalae*, and this taxon was included with *S. kaalae* by Weller and Sakai (1990: 838) based on study of the type. Our greenhouse study shows that the Ko'olau Mountain plants differ in several characters, although the relationship to *S. kaalae* is very close. The morphological distinctions coupled with the geographical separation of about 30 km support recognition of the Ko'olau plants as a subspecies of *S. kaalae*.

Stenogyne species on younger islands of Maui and especially Hawai'i are more polymorphic than the species on the older islands of O'ahu and Kaua'i (Weller & Sakai, 1990). Similar patterns of greater polymorphism within species on the younger islands occur in a number of other genera including *Cyrtandra* J. R. Forster & G. Forster (Gesneriaceae), *Labordia* Gaudichaud (Loganiaceae), *Lysimachia* L. (Primulaceae), *Melicope* J. R. Forster & G. Forster (Rutaceae), *Myrsine* L. (Myrsinaceae), and *Phyllostegia* (Lamiaceae). Extinction of intermediate forms and evolution of novel forms on older islands, as well as increasing isolation resulting from erosion and dissection of habitats, are likely explanations for the greater ease in delimiting species on the older Hawaiian Islands. These factors could explain the patterns of variability seen in *Stenogyne* and other genera, where more narrowly distributed, less polymorphic species are found on the older islands. *Stenogyne sherffii* is an example of a species where geographic isolation has led to

well-defined, through modest, differentiation from *S. kaalae*. In contrast, differences among populations found on the island of Hawai'i may be of greater magnitude, but lack consistency on a geographic basis. Lack of consistency in the distribution of characters prevents recognition of infraspecific taxa within these species and provides the rationale for use of a broadly defined species for many of the *Stenogyne* taxa found on the island of Hawai'i.

Comparison of several closely related taxa of *Stenogyne* illustrates patterns of variation related to island age that require different taxonomic approaches and demonstrate why species-level recognition is given in most of these cases, while subspecies level is used for *S. sherffii*. *Stenogyne macrantha* Bentham and *S. scrophularioides* Bentham, two polymorphic species from the island of Hawai'i, are very distinct in some areas in both vegetative and floral characters, but show considerable morphological overlap in other areas. Populations that are intermediate may result from areas of secondary contact or represent the extremes of variation in a recently diverged ancestral species. Without extensive study, these hypotheses cannot be differentiated, and at present recognition of two broadly defined species captures the essence of variation in these entities. In contrast, differentiation is geographically and ecologically well marked for a morphologically distinct pair of species from East Maui; the extinct *S. haliakalae* Wawra, which occurred at lower and drier elevations on the south slopes of Haleakala, and *S. rotundifolia* A. Gray, a species still common at higher, wetter elevations on the north slopes of Haleakala. A third pattern of variation is exemplified by *S. purpurea* H. Mann and *S. kealiae* Wawra, both endemic to Kaua'i. These species differ only in vegetative characters, but rare and narrowly distributed *S. kealiae* occurs sympatrically with the widespread *S. purpurea*, and therefore they are considered distinct species. *Stenogyne sherffii* and *S. kaalae*, which like *S. kealiae* and *S. purpurea* on Kaua'i differ only in vegetative characters, are completely allopatric in the same habitat type. The minor, strictly vegetative differences and the allopatric distribution of *S. sherffii* and *S. kaalae* provide the justification for subspecific recognition.

KEY TO THE SUBSPECIES OF *STENOGYNE KAALAE*

1a. Leaf margins inconspicuously serrulate, the blades 8–12 cm long, 2–3.5 cm wide, coriaceous; stems glabrous; pedicels 2–5 mm long . . . . . subsp. *sherffii*

1b. Leaf margins serrate, the blades 4.2–7.7 cm long, 1.7–2.9 cm wide, thin and membranous; stems usually pubescent; pedicels 4–7 mm long . . . . . subsp. *kaalae*

Stenogyne kaalae Wawra subsp. **sherffii** (O. Degener) W. L. Wagner & Weller, comb. et stat. nov. *Stenogyne sherffii* O. Degener, Brittonia 5: 58. 1943. TYPE: Hawaiian Islands [U.S.A.]. O'ahu: [Ko'olau Mountains], Kawailoa, Pe'ahinai'a trail, 28 Apr. 1940, *O. Degener & Ordoñez 12999* (holotype, NY; isotype, NY).

Scandent vines, climbing or sprawling and rooting at the nodes; stems 2.5–6 m (in cultivation), quadrangular, glabrous. Leaves glossy, coriaceous, lanceolate, the blades 8–12 cm long, 2–3.5 wide, antrorsely strigulose along the adaxial midvein, otherwise glabrous, margins inconspicuously serrulate, apex acute to weakly acuminate, base cuneate, petioles 1–2 cm long. Flowers (3)5 per verticillaster, sometimes some of them on a peduncle up to 2–5 mm long, pedicel 2–5 mm long, retrorsely strigulose; calyx nearly radially symmetrical, narrowly campanulate, 9–15 mm long at anthesis, green or tinged purple, glabrous, the teeth linear-lanceolate, 5–8 mm long; corolla very dark maroon, hispidulous externally, the hairs weakly antrorse, the margins and inner surfaces glandular puberulent, the tube mostly straight, curved slightly at the throat, 11–12 mm long, upper lip 9–10 mm long, lower lip 2–3 mm long. Nutlets 4 mm long, fleshy, dark purple.

Distribution. Known only from the Pe'ahinai'a Trail in the northern part of the Ko'olau Mountains, O'ahu, from only two collections (1940 and 1994). Apparently there is only a single extant population with perhaps five individuals (J. Obata, pers. comm.).

Specimen examined. HAWAIIAN ISLANDS [U.S.A.]. **O'ahu:** Ko'olau Mountains, Pe'ahinai'a Trail, 1994, *Obata s.n.* (US), cultivated in 1997 from *Obata s.n.* (BISH, F, K, US).

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New Species of *Justicia* (Acanthaceae) from Cerro La Chapa, El Amparo, Venezuela

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ABSTRACT. Current research in the cloud forest of Cerro La Chapa, El Amparo, by Winfried Meier has resulted in the recognition of a new species of *Justicia*. This new species, *Justicia chapana*, previously misidentified as *J. galapagana* Lindau, is described, illustrated, and compared to the latter, its closest relative, from the Galápagos Islands.

Justicia is the largest and taxonomically most complex genus of Acanthaceae, with ca. 600 species worldwide (Graham, 1988; Mabberley, 1997). It is also the largest genus of the family in Venezuela, with about 45 species found there. The genus is characterized by the upper corolla lip rugulate, androecium of two 2-thecous stamens and no staminodes, 2- or 3-aperturate pollen with a trema area usually traversed by 2–8 rows of up to 10 insulae (Fig. 2), and stipitate capsules with four (or fewer) seeds.

Justicia chapana Wasshausen, sp. nov. TYPE: Venezuela. Yaracuy: El Amparo, 7 km N of Salom, 110–1200 m, 1 Dec. 1974, *J. Steyermark, Carreño Espinoza, C. Steyermark & Diederichs 111211* (holotype, US; isotype, VEN). Figures 1, 2.

Herba, caulibus quadrangularibus, puberulis et glanduloso-pilosis. Foliorum lamina lanceolata vel parce ovata, membranacea, utrinque parce puberula, costa et venis lateralibus puberulis, acuminata, basi attenuata. Inflorescentiae pauciflorae, axillares, dichotomae, folia aequantes, apice spiciformes, flores in axillis bractearum alternantibus, glanduloso-pilosi; bracteae bracteolaeque subulatae; calycis segmenta 4, lance-subulata; corolla lavendulacea vel profunde atrorosea-purpurea, 6–7 mm longa, pilosa, tubo 3–4 mm longo, labio superiore anguste ovato, apice cuculato et rotundato; stamina exserta; lobis antherarum leviter superpositis.

Branching herb 0.5 m tall. Stems ascending, quadrangular-ridged, conspicuously puberulous and glandular-pilose, trichomes erect, gland-tipped, others ± spreading. Leaves petiolate, petioles 10–15 mm long, pubescence similar to that of stem, blades lanceolate to narrowly ovate, 5–7.5 × 2–3.3 cm, membranous, dull green, sparingly and inconspicuously puberulent both above and below, especially on costa and lateral veins, trichomes erect or appressed, eglandular or glandular, cystoliths usually obscure, apex long-acuminate, base attenuate, margin entire to obscurely crenulate; leaves subtending inflorescence much reduced, narrower than cauline leaves. Inflorescence few-flowered, axillary, dichotomously branched spikes, these barely exceeding terminal leaves, densely glandular-pilose, trichomes interspersed both glandular and eglandular. Flowers alternate, pedicels almost none; bracts and bracteoles subulate, 3–3.5 × 0.5 mm, pubescence intermixed pilose and glandular-pilose; calyx 4.5–5.5 mm long, deeply 4-parted, lobes lance-subulate, 3–4.5 × 0.75–1 mm, pubescence similar to that of the bracts and bracteoles; corolla rich lavender to deep rose-purple, 6–7 mm long, externally moderately pilose, tube 3–4 mm long, basally 1.2–1.5 mm wide, throat 2.5–3 mm wide, upper lip narrowly ovate, 3–4 mm long, basally 4 mm wide, apically cucullate and rounded, folded longitudinally inside, lower lip 3-lobed, lobes narrowly ovate to elliptic, 1.5–2 mm long, 1.5 mm wide, undulate at tip; stamens exserted; filaments slender, flattened, 2 mm long, glabrous, anther thecae obliquely attached to a flattened connective, upper thecae obtuse, 1 mm long, lower thecae 1 mm long, apiculate at base; pollen grains 2-porate, bilateral, 50 × 30 μm, trema area microreticulate, traversed by 2 rows peninsulae (Fig. 2); ovary pubescent, brownish, style filiform, 5 mm long, pubescent, stigma oblique. Capsule 4-seeded, clavate, 13–14 × 3–3.5 × 3 mm, seed-bearing-portion brownish, densely pilose, trichomes both eglandular and glandular; retinacula 2 mm long, slightly curved; seeds suborbicular, 1.5 mm diam., densely pubescent with glochidiate trichomes.

Distribution. Endemic to Venezuela; plants occur in cloud forests and along upper slopes of rivers, in the departments of Carabobo, Yaracuy, Cojedes, Lara, Portuguesa, and Trujillo at elevations from 700 to 2300 m.

Justicia chapana superficially resembles *J. gal-*

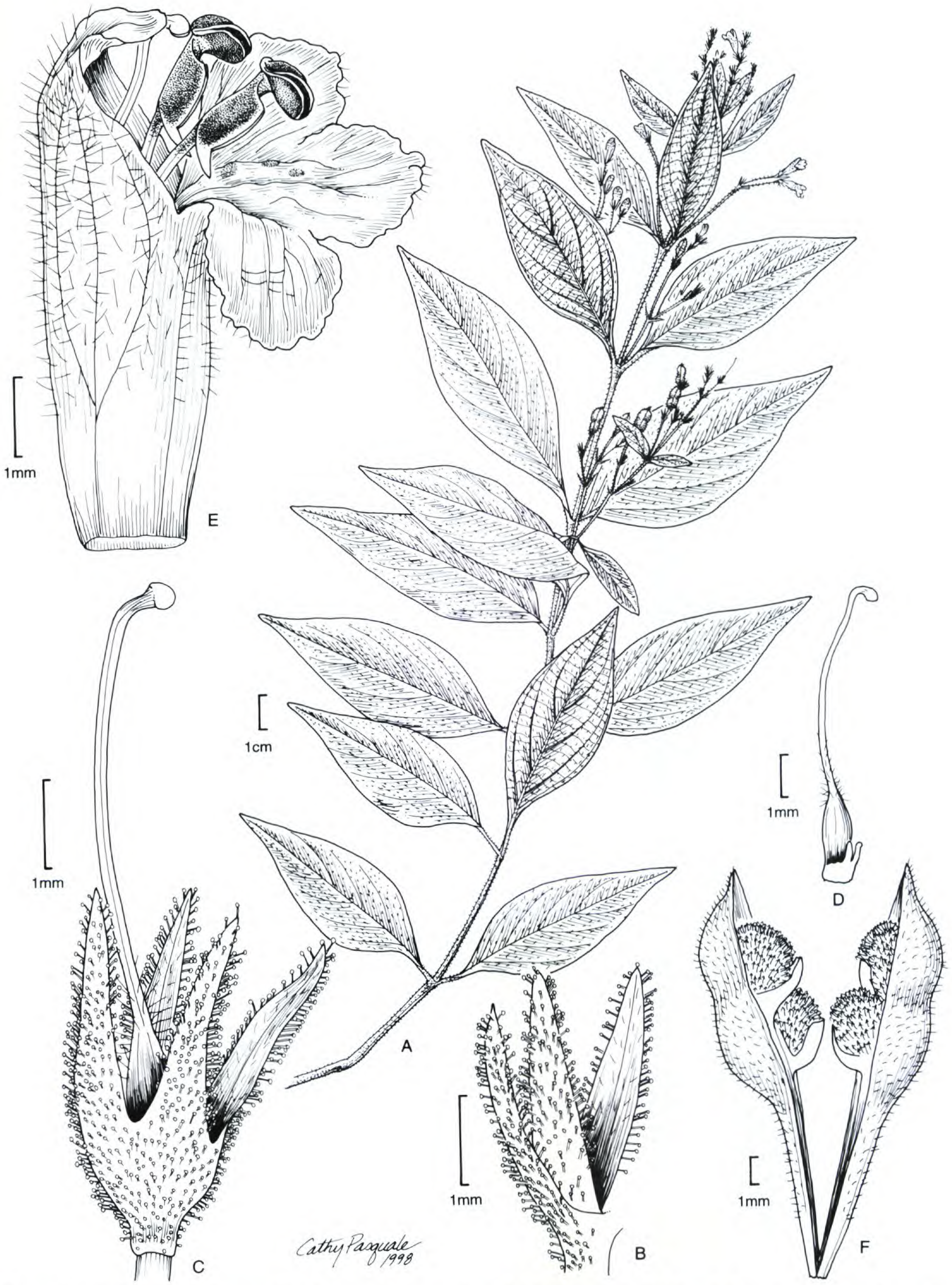

Figure 1. A–F. *Justicia chapana* Wasshausen (*Steyermark et al. 111211*). —A. Habit. —B. Bract and bracteoles. —C. Calyx and pistil. —D. Pistil, ovary, cupula, and glands. —E. Corolla, stamens, and pistil. —F. Capsule, retinacula, and seeds.

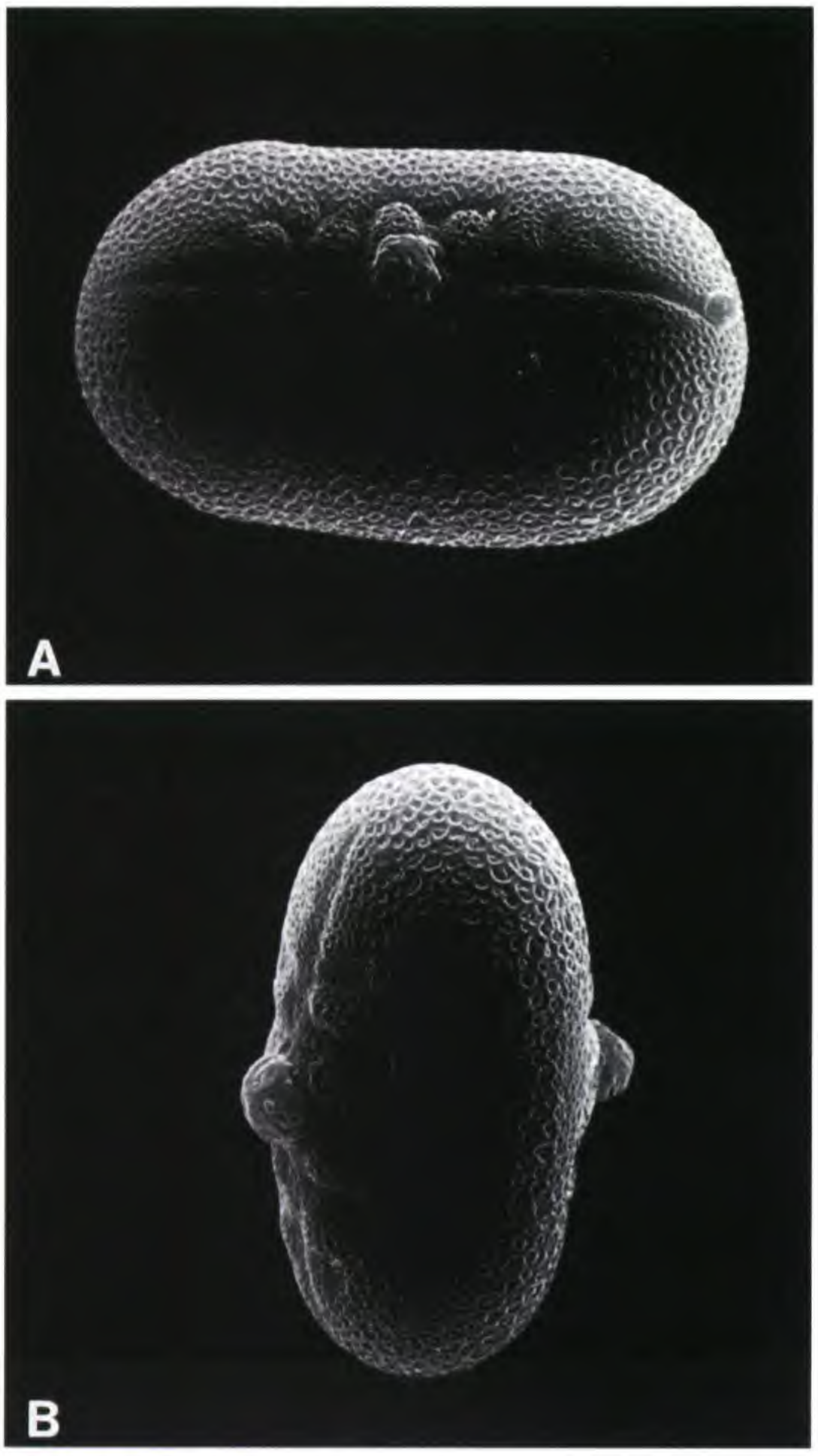

Figure 2. Scanning electron (SEM) photomicrographs of *Justicia chapana* pollen. A, B. *J. chapana* (*Steyermark & Bunting 105258*). —A. Equatorial view, ×1145. —B. Equatorial view, ×1215.

apagana Lindau from the Galápagos Islands; in fact, J. Steyermark identified his Venezuelan specimens as *J. galapagana*. In *J. galapagana* the corollas are considerably larger, 10–14 mm long, purple, the tube is 4–6 mm long, the upper lip is apically somewhat dentate, the middle lobe of the lower lip is distinctly masked with maroon nectar guides, and the leaf blades are basally abruptly narrowed. By contrast, in *J. chapana* the corollas are 6–7 mm long, rich lavender to deep rose-purple, the tube is 3–4 mm long, the upper lip is apically cucullate and rounded, the middle lobe of the lower lip is not reported to have maroon markings, and the leaf blades are basally attenuate. The new species is placed in Graham's (1988) section *Sarotheca*, which is characterized by its compound spicate inflorescence with a glandular axis, and by its type 6 pollen.

Paratypes. VENEZUELA. **Carabobo:** road to Tinaquillo, *Pittier 11986* (US). **Yaracuy:** Cerro La Chapa, selva nublada al norte de Nirgua, 1200–1400 m, *Steyermark, Bunting & Wessels-Boer 100289* (US, VEN), *Steyermark & Bunting 105258* (US, VEN); selva nublada en la fila y las laderas superiores, entre Salom y Temerica, 100 m, *Steyermark, Bunting & Wessels-Boer 100359* (US, VEN); 7.5 km N of Salom, 10°15′N, 68°29′W, 1200–1300 m, *Liesner & Steyermark 12406* (MO, US); Quebrada Honda, 17.3 km del pueblo de Arva, 1100 m, *Steyermark 105411* (US, VEN). **Cojedes:** Dtto. San Carlos, Mun. Rómulo Gallegos, *Llamozas 147* (US). **Lara:** Dtto. Moran, between Humocaro Alto and La Mesa, 1100 m, *Steyermark & Carreño Espinoza 111039* (US, VEN). **Portuguesa:** Dtto. Sucre, la carretera Gavilán–Mijagual–Mesa de Bucaral, 15 km S-SE of Biscucuy, 700 m, *Aymard et al. 3695* (PORT, US); Dtto. Guanare, along Río Guanare, above Mijagual, *Stergios et al. 8758* (PORT, US). **Trujillo:** Dtto. Bocono, La Morita, above Río Saguarás, S of Campo Elias and ca. 3 km W of Trujillo-Portuguesa state line, 2300 m, *Dorr et al. 5381* (NY, US).

Acknowledgments. My special thanks to Cathy Pasquale for skillfully preparing the line drawing, and to the staff of the National Museum of Natural History SEM Laboratory for their high-quality pollen photomicrographs.

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New Combinations in Chinese *Kobresia* (Cyperaceae)

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ABSTRACT. Three new subspecific combinations are proposed in the genus *Kobresia*: *K. myosuroides* (Villars) Fiori subsp. *bistaminata* (W. Z. Di & M. J. Zhong) S. R. Zhang, *K. royleana* (Nees) Boeckeler subsp. *minshanica* (Wang & Tang ex Y. C. Yang) S. R. Zhang, and *K. setschwanensis* Handel-Mazzetti subsp. *squamaeformis* (Y. C. Yang) S. R. Zhang. Additionally, *K. kashgarica* Dickoré is treated as a synonym of *K. myosuroides* subsp. *bistaminata* and *K. menyuanica* Y. C. Yang as a synonym of *K. royleana* subsp. *minshanica*.

In preparing the account of *Kobresia* for the forthcoming volume of *Flora of China*, the following new combinations have been found necessary.

Kobresia myosuroides (Villars) Fiori subsp. **bistaminata** (W. Z. Di & M. J. Zhong) S. R. Zhang, comb. nov. Basionym: *Kobresia bistaminata* W. Z. Di & M. J. Zhong, Acta Bot. Bor.-Occid. Sin. 6: 275. 1986. TYPE: China. Nei Mongol: Helanshan, Halawugou, 25 July 1984, *EHNWU* [*Northwest University Expedition to Helanshan*] *6051* (holotype, WNU).

Kobresia kashgarica Dickoré, Stapfia, 39: 79. 1995. Syn. nov. TYPE: China. Xinjiang: Kunlun Shan, Tiznap, tributary valley W of Kudi, 36°51′N, 76°57′E, 4040 m, 9 July 1992, *G. & S. Miehe 8471* (holotype, K; isotypes, GOET, PE).

Kobresia myosuroides is widespread in the Northern Hemisphere, with a range extending from northern China to the Arctic region. Plants of northwestern China (from western Nei Mongol to western Xinjiang), which were described as *K. bistaminata* and *K. kashgarica* and treated here as the subspecies *bistaminata*, differ from those of the rest of the species range in having slightly smaller (2.5–3.5 mm long) glumes with a narrowly hyaline or not hyaline margin and smaller nuts 1.8–2.3 mm long. In contrast, subspecies *myosuroides* has glumes (2–) 3–4 mm long with a broadly hyaline margin and nuts 2–2.8 mm long.

Kobresia royleana (Nees) Boeckeler subsp. **minshanica** (Y. C. Yang) S. R. Zhang, comb. nov. Basionym: *Kobresia minshanica* Wang & Tang ex Y. C. Yang, Acta Biol. Plateau Sin. 2: 1. 1984. TYPE: China. Gansu: Minxian, 10 Aug. 1978, *J. Q. Wang 228* (holotype, NWTC).

Kobresia menyuanica Y. C. Yang, Acta Biol. Plateau Sin. 2: 3. 1984. Syn. nov. TYPE: China. Qinghai: Menyuan, 6 Sep. 1980, *X. M. Zhou 273* (holotype, HNWP).

Kobresia royleana is distributed in the central Asian highlands and Himalayas. Plants of subspecies *minshanica*, which are restricted to eastern Qinghai and Gansu, are rather slender and often have unisexual lateral spikelets with one female flower, whereas those of subspecies *royleana* are stout and have bisexual lateral spikelets with a basal female flower and several distal male flowers.

Kobresia setschwanensis Handel-Mazzetti subsp. **squamaeformis** (Y. C. Yang) S. R. Zhang, comb. nov. Basionym: *Kobresia squamaeformis* Y. C. Yang, Acta Biol. Plateau Sin. 2: 9. 1984, sphalm. "squmaeformis." TYPE: China. Gansu: Xiahe, 3300–3600 m, 14 Aug. 1980, *H. T. Zhao s.n.* (holotype, LZU).

In the protologue of *Kobresia squamaeformis*, the species was considered similar to *K. pygmaea* C. B. Clarke and *K. bellardii* (Allioni) Degland (= *K. myosuroides*). I have studied the type specimen of *K. squamaeformis* and have seen it in the field in Zeku, Qinghai. It is most closely related to *K. setschwanensis*. Although the taxon is distinguishable from *K. setschwanensis* on the basis of basal sheaths, glumes, prophylls, and nuts, it can be distinguished by being shorter (7–16 cm) and having unbranched inflorescences 8–12 mm long and unisexual or sometimes bisexual lateral spikelets with a basal female flower and a distal male flower. In contrast, *K. setschwanensis* is taller (10–40 cm high) and often has basally branched inflorescences 20–25 mm long and bisexual spikelets with a basal female flower and (1)2–6 distal male flowers. Subspecies *squamaeformis* is distributed in eastern Qinghai and adjacent Gansu, while subspecies *setschwanensis* occurs in southern Qinghai, Sichuan, Yunnan, and Xizang (Tibet).

Acknowledgment. I thank Ihsan Al-Shehbaz for his help with the manuscript.

Cypripedium taibaiense (Orchidaceae), a New Species from Shaanxi, China

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ABSTRACT. *Cypripedium taibaiense* G. Zhu & S. C. Chen, a new species from Taibai Mountain in Shaanxi, northwestern China, is described and illustrated. The species belongs to section *Cypripedium* subsection *Macrantha* (Kränzlin) Cribb. It resembles *C. yunnanense* Franchet in having small flowers but differs from it in having ovaries pubescent at least along the ribs, oblong staminodes almost twice as long as wide, untwisted petals, and in having dorsal sepals elliptic-lanceolate more than twice as long as wide.

During a recent trip of the senior author to China in 1998, several plants of *Cypripedium*, which were said to have been collected from the provinces of Gansu and Shaanxi in northwestern China, were bought from a floral market in Beijing. Among the already withered and poorly preserved flowers, one was still distinguishable and did not seem to be any known species of the genus. This plant was brought to the Institute of Botany, Chinese Academy of Sciences, for study. It does not match any species already described but is identical with several unidentified specimens in the PE herbarium, which were collected from Taibai Mountain in Shaanxi, China. The features of single purple flower, villose ovaries, alternate ovate leaves, and staminode nearly sessile indicate that these specimens belong to the section *Cypripedium* subsection *Macrantha* (Kränzlin) Cribb. The specimens were compared with species of wide distribution or those found in neighboring provinces in the subsection *Macrantha*, namely, *C. franchetii* Rolfe (Gansu, Shanxi, Shaanxi, Henan, Hubei, and Sichuan), *C. micranthum* Franchet (Heilongjiang, Jilin, Liaoning, Inner Mongolia, Hebei, Shandong, and Taiwan), *C. smithii* Schlechter (Sichuan and Yunnan), *C. tibeticum* King ex Hemsl. (Gansu, Sichuan, Guizhou, Yunnan, and Tibet), and *C. yunnanense* (Sichuan, Yunnan, and Tibet). The comparison indicated that the specimens belong to a new member of the subsection. This undescribed species is superficially similar to *C. franchetii*, but differs in having much smaller flowers and less pubescent ovaries. It resembles *C. yunnanense* Franchet in its small flowers, but differs in having ovaries with pubescence at least along the ribs, oblong staminodes almost twice as long as broad, untwisted petals, and in having dorsal sepals elliptic-lanceolate more than twice as long as wide.

Cypripedium taibaiense G. Zhu & S. C. Chen, sp. nov. TYPE: China. Shaanxi: Taibai County, Taibai Mountain, 3300 m, 4 July 1959, *J. X. Yang 629* (holotype, PE). Figure 1.

Inter species subsectionis *Macranthorum* flore parvo ad *Cypripedium yunnanense* accedens sed ovario pubescenti, petalis non tortis, staminodio oblongo 1–1.1 cm longo, 5–6 mm lato subduplo longiore quam latiore, sepalo dorsali longiore quam latiore.

Terrestrial herb, 13–15(–24) cm tall, with stout rhizome 4–5 cm long and 4–5 mm thick. Stem glabrous, bearing 2–3 sheaths at base and 3–4 leaves well spaced above pointing upward. Leaves elliptic or elliptic-lanceolate, 4.5–11 cm long, 2.8–3.5 cm wide, acuminate or subacute, sheathing and amplexicaul at base, glabrous above, minutely pubescent or glabrescent beneath, ciliate. Inflorescence terminal, 1-flowered; peduncle 3–7(–10) cm long, minutely pubescent; bract narrowly elliptic or narrowly elliptic-lanceolate, 6–6.5 cm long, 1.8–2.2 cm broad, acuminate, minutely pubescent on both sides or glabrescent above, ciliate on margins. Pedicel and ovary 1.7–2 cm long, pubescent at least along the ribs; flower 4–4.5 cm across, purple-red; dorsal sepal elliptic-ovate, 2.2–3 cm long, 1.3–1.5 cm wide, acuminate, glabrous; synsepal ovate-elliptic to narrowly elliptic, 2.2–2.8 cm long, 1–1.2 cm wide, bifid at apex, glabrous; petals lanceolate, 2.6–3 cm long, 7–9 mm wide, villose in basal half of adaxial surface; lip deeply pouched, obovate-subglobose, 2.5–3 cm long, 1.5–2 cm broad, pu-

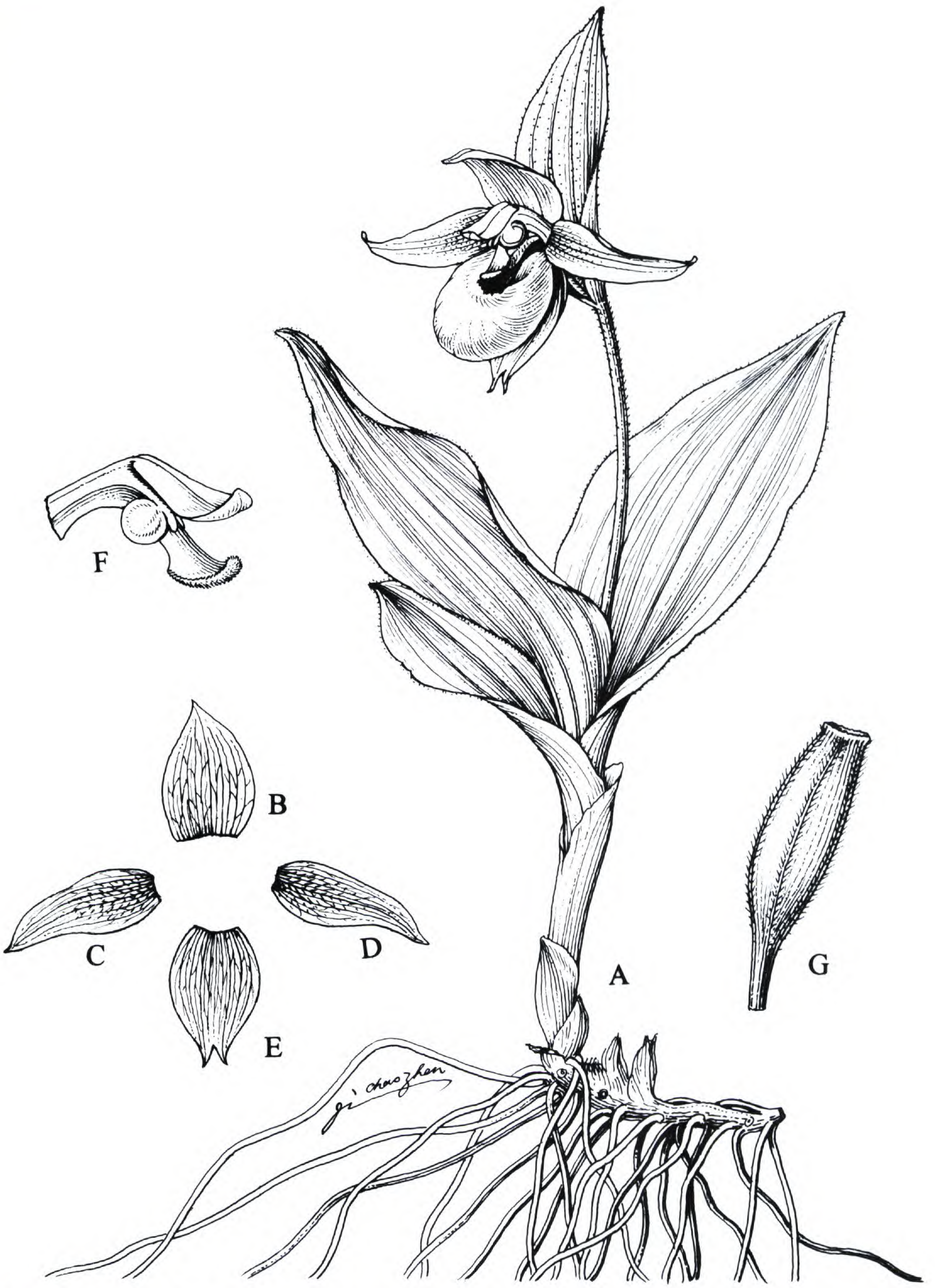

Figure 1. Line drawing of the type by Ji Chaozhen. —A. Plant ×1. —B. Dorsal sepal ×1. —C. Petal ×1. —D. Petal ×1. —E. Synsepal ×1. —F. Column ×2. —G. Ovary ×3.

bescent inside, glabrous outside, with mouth ca. 1.2–1.4 cm across; staminode oblong, 1–1.1 cm long, 5–6 cm wide, longitudinally grooved along the midrib, carinate beneath, mucronate at apex; filaments linear, 3 mm long. Flowering from June to July.

Cypripedium is mainly a temperate genus, consisting of about 45 species (Cribb, 1997) distributed largely in eastern Asia and North America. Over two-thirds of the species, about 32, are found in China (Chen & Xi, 1987; Chen & Tsi, 1998). Many species in the genus are of horticultural importance, attracting worldwide attention due to their large and showy flowers. Some are also of phytogeographic significance, several pairs of vicarious species being disjunctly distributed in eastern Asia and eastern North America (Chen, 1983a). Although this interesting genus was recently revised by Cribb (1997), field studies are still needed, particularly on the poorly known Chinese species. Among the currently recognized species from China, many, such as *C. wardii* Rolfe, *C. farreri* W. W. Smith, *C. micranthum*, *C. fasciolatum* Franchet, *C. palangshanense* T. Tang & F. T. Wang, *C. yunnanense*, and *C. smithii*, are known from only a few or single collections. A number of new species have been described from China in recent years, namely *C. shanxiense* S. C. Chen (Chen, 1983b), *C. wumengense* S. C. Chen (Chen, 1985), *C. subtropicum* S. C. Chen & K. Y. Lang (Chen & Lang, 1986), *C. forrestii* Cribb (Cribb, 1992), *C. lichiangense* S. C. Chen & Cribb (Cribb & Chen, 1994), and *C. ludlowii* Cribb (Cribb, 1997). The new species is the only member of the genus currently known from Shaanxi Province in China. As the remote regions of Shaanxi and neighboring Gansu Province contain many suitable habitats for *Cypripedium* species, such as mixed deciduous forest and mossy and grassy slopes and bogs, it is likely that more undescribed species will be discovered if more herbarium material from those regions becomes available.

Paratypes. CHINA. **Shaanxi:** Taibai County, Taibai Mountain, grassy slopes, 2600–3300 m, *S. F. Li 91009* (MO, WUK), *T. P. Wang 1698* (PE, WUK), *J. X. Yang 581* (PE, WUK), *J. X. Yang 885* (PE, WUK).

Acknowledgment. We are grateful to the curators of MO, PE, and WUK for making the specimens available for this study.

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New Combinations in *Packera* (Asteraceae) and Lectotypification of *Packera ovina*

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ABSTRACT. Four new combinations are made for *Packera*: *P. eurycephala* var. *lewisrosei* (J. T. Howell) Bain, *P. contermina* (Greenman) Bain, *P. moresbiensis* (Calder & Taylor) Bain, and *P. ovina* (Greene) Bain. *Packera ovina* is lectotypfied. The latter is necessary because the holotype is a mixed collection whose disposition affects the naming of *Packera contermina.*

The segregate genus *Packera*, including those species of *Senecio* previously referred to as members of the aureoid complex of *Senecio*, will be recognized in the upcoming treatment of the Asteraceae for *Flora of North America (North of Mexico).* Most of the needed combinations have been made by previous authors (Freeman & Barkley, 1995; Löve & Löve, 1976; Jeffrey, 1992; Weber & Löve, 1981), but recent work involving some arctic and Rocky Mountain species of this complex has brought to my attention the necessity of making a few new combinations immediately. They are presented below. In addition, I discuss the type material of *Senecio ovinus* because it has possible implications for naming *Senecio conterminus.*

Packera eurycephala var. **lewisrosei** (J. T. Howell) Bain, comb. nov. Basionym: *Senecio lewisrosei* J. T. Howell, Leafl. West. Bot. 3: 141. 1942. *Senecio eurycephalus* var. *lewisrosei* (J. T. Howell) T. M. Barkley, Brittonia 20: 283. 1968. TYPE: U.S.A. California: Butte Co., near Pulga, *L. Rose 39247* (holotype, CAS).

Packera contermina (Greenman) Bain, comb. nov. Basionym: *Senecio conterminus* Greenman, Ann. Missouri Bot. Gard. 3: 101. 1916. Based on *Senecio Lyallii* Klatt, Annal. Naturhist. Hofm. Wien 9: 365. 1894, not Hooker f. TYPE: [Canada.] Summit of the Rocky mountains, *D. Lyall s.n.* (GH).

Packera moresbiensis (Calder & Taylor) Bain, comb. nov. Basionym: *Senecio cymbalarioides* Buek subsp. *moresbiensis* Calder & Taylor, Canad. J. Bot. 43: 1399. 1965. *Senecio moresbiensis* (Calder & Taylor) Douglas & Douglas, Canad. J. Bot. 56: 1710. 1978. *Senecio streptanthifolius* var. *moresbiensis* (Calder & Taylor) Boivin, Naturaliste Canadien 93: 1031. 1966. TYPE: [Canada.] British Columbia: Queen Charlotte Islands, Moresby Island, *J. Calder, D. Savile & R. Taylor 23006* (holotype, DAO).

Packera ovina (Greene) Bain, comb. nov. Basionym: *Senecio ovinus* Greene, Pittonia 4: 110. 1900. TYPE: [Canada.] Alberta: Sheep [= Sofa] Mountain, *J. Macoun 11619* (lectotype, selected here, NDG in part, glabrous individuals). Figure 1.

TYPE MATERIAL OF *SENECIO OVINUS*

Senecio ovinus Greene was described in 1900 from collections made from the Sheep Mountain region of southern Alberta (*Macoun 11619*). The locality appears on modern maps as Sofa Mountain, situated on the eastern boundary of Waterton Lakes

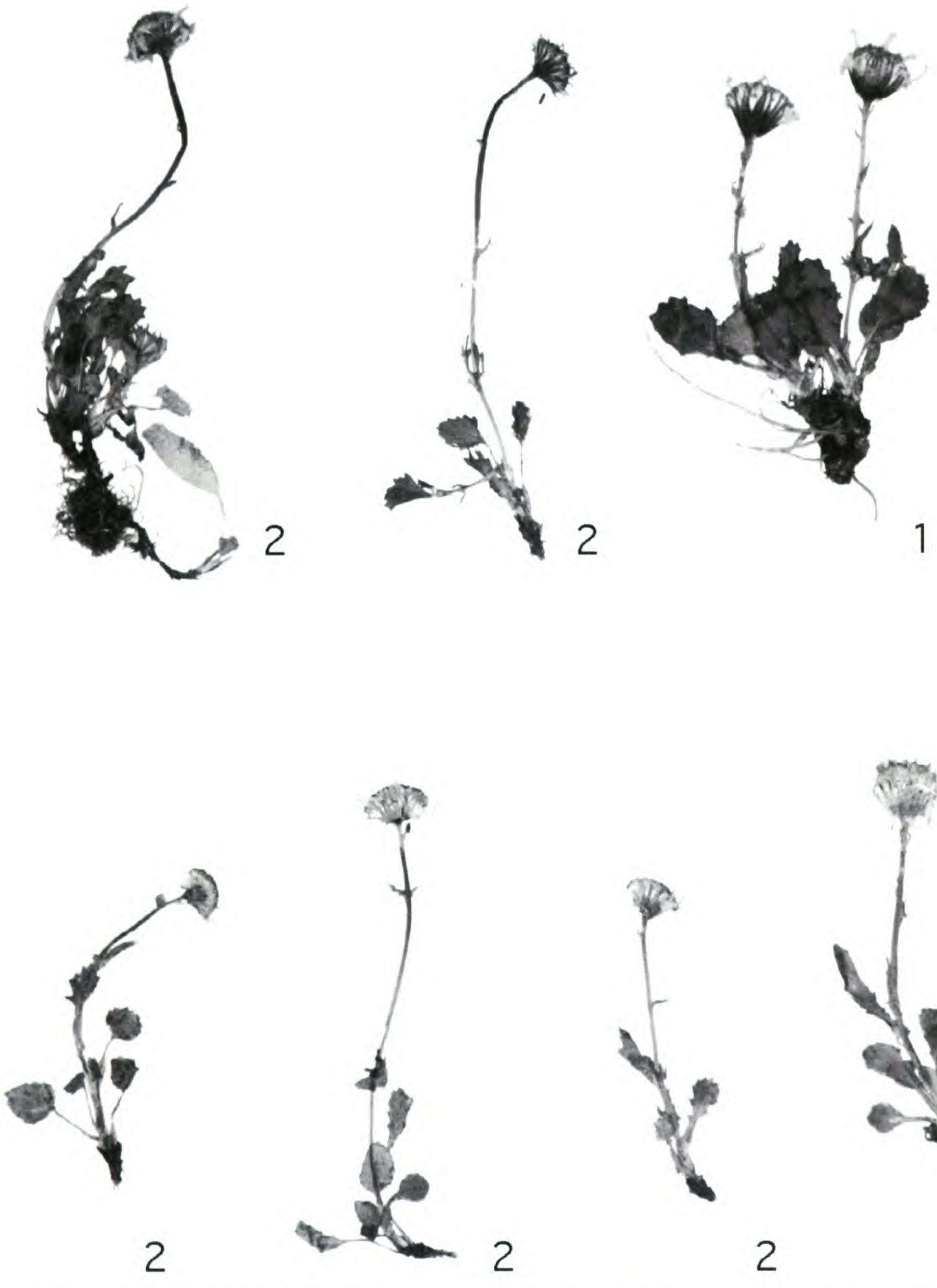

Figure 1. Lectotype of *Packera ovina* (Greene) Bain. —1. *Packera contermina* individuals. —2. *Packera ovina* individuals.

National Park. *Senecio ovinus* was recognized as distinct from *S. cymbalarioides* Buek (= *S. subnudus* DC.) by Greenman (1916), primarily based on its "thickish" rather than thin leaves. The name was considered a synonym of *S. cymbalaria* Pursh (= *S. resedifolius* Lessing) in most recent treatments including those by Barkley (1962, 1978, 1981), Cronquist (1955, 1960), Hultén (1950), and Kowal (1975), all of whom recognized *S. cymbalaria* as distinct from *S. cymbalarioides* Buek and described both as occurring in the southern Rocky Mountains. Packer (1972) also recognized two taxa in the

southern Rocky Mountains, but considered them to be *S. cymbalarioides* Buek and *S. conterminus* Greenman. He did not, however, clearly indicate the relationship of *S. ovinus* to the latter two taxa. Recent treatments following Packer (1972) include those by Moss (1983) and Douglas (1982). The latter author treated *S. ovinus* as a synonym of *S. cymbalarioides* Buek. Thus, all modern treatments recognize two taxa in southern Alberta, and treat *S. ovinus* as a synonym of either *S. cymbalarioides* or *S. conterminus/S. cymbalaria*. The latter taxon is treated as *S. conterminus* in the present discussion.

An examination of the holotype and isotypes of *S. ovinus* has revealed that the type collection (*Macoun 11619*) contains individuals of both *S. conterminus* and *S. cymbalarioides*. The isotypes at NY and US are referable to *S. conterminus*, while those at CAN and GH are *S. cymbalarioides*. The holotype sheet at NDG contains individuals of both *S. cymbalarioides* and *S. conterminus*.

According to Article 9.10 of the *Code* (Greuter et al., 1994), when a type herbarium sheet contains parts belonging to more than one taxon, the name must remain attached to that part that corresponds most nearly with the original description. In addition, Recommendation 9A.5 indicates that the lectotype should be chosen to preserve current usage. A comparison of Greene's original description with the holotype sheet reveals that it fits all of the individuals relatively well. The presence of floccose tomentum, at least in the leaf axils, is important inasmuch as it is characteristic of *S. conterminus*, but even with regard to this character, Greene described the petioles of *S. ovinus* as "flocculent, at least when young," implying that not all of the individuals he observed had flocculent petioles. Since the petioles of individuals of *S. cymbalarioides* are glabrous, this is not surprising. It should be noted that Greenman did not indicate having seen the holotype of *S. ovinus* when he recognized it as distinct in his 1916 monograph. He relied on the type material from GH and CAN, which, as previously noted, is comprised entirely of glabrous individuals, here treated as *S. cymbalarioides*. His presumably later annotation of the holotype indicates clearly that he, too, could see that the specimen is composed of two elements, which he referred to as *S. conterminus* and *S. ovinus*.

I lectotypify *S. ovinus* Greene by designating the glabrous individuals on the sheet as the type material, thus treating it in the same manner as Greenman, whose annotation appears on the sheet. The elements selected are consistent with the original description and preserve current usage by allowing the name to remain in synonymy, albeit with *S. cymbalarioides* not *S. cymbalaria*. Were the floccose individuals (*S. conterminus*) to have been chosen as lectotype, then the name *S. conterminus* Greenman would become a synonym of *S. ovinus* Greene, necessitating a name change for those who, like Packer (1972), recognize two taxa in southern Alberta and surrounding areas, neither of which is *S. cymbalaria*.

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New Combinations in Californian *Arnica* and *Monolopia* (Compositae)

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ABSTRACT. New combinations in *Arnica* L. and *Monolopia* DC. are made in light of evidence from a phylogenetic study of helenioid Heliantheae that each of the two genera is paraphyletic. Transfers herein of *Whitneya dealbata* A. Gray to *Arnica* and *Lembertia congdonii* (A. Gray) Greene to *Monolopia* allow for circumscriptions of *Arnica* and *Monolopia* that better reflect phylogenetic relationships.

Results of a phylogenetic study of helenioid Heliantheae or Helenieae sensu lato (Baldwin & Wessa, 1997, & unpublished) lead me to conclude that *Arnica* L. and *Monolopia* DC. are each paraphyletic. The following combinations are needed to make *Arnica* and *Monolopia* monophyletic.

Arnica dealbata (A. Gray) B. G. Baldwin, comb. nov. Basionym: *Whitneya dealbata* A. Gray, Proc. Amer. Acad. Arts 6: 550. 1865. TYPE: U.S.A. California: "dry woods on the Yosemite trail, alt. 7,000 feet," 1863, *W. H. Brewer 1627* (holotype, GH).

In his description of *Whitneya*, Asa Gray (1865) noted morphological similarities to *Arnica*, but absence of pappus in *Whitneya* made its relationships difficult to assess. Hoffmann (1890) placed *Whitneya* with *Baileya* Harvey & A. Gray ex Torrey and *Psilostrophe* DC. in subtribe Riddeliinae on the basis of shared persistence of the ray corollas, a treatment followed by later workers such as Rydberg (1914) and Keck (1959). Ornduff et al. (1967) concluded from cytological and morphological considerations that *Whitneya* is closely related to *Arnica*, a view subsequently endorsed by Turner and Powell (1977) and Nordenstam (1977) and implicit in Robinson's (1981) and Karis and Ryding's (1994) placement of *Arnica* and *Whitneya* together in Chaenactidinae. Results from phylogenetic analyses of nuclear ribosomal DNA sequences provide strong support for a nested position of *Whitneya* within a group corresponding to *Arnica* sensu Maguire (1943) plus *A. mallotopus* (Franchet & Savatier) Makino [= *Mallotopus japonicus* Franchet & Savatier].

Like other species of *Arnica*, *A. dealbata* is a rhizomatous perennial with opposite leaves and each ray floret associated with a phyllary. The chromosome number reported for *A. dealbata* is $2n = 19$ II, corresponding to the diploid condition in *Arnica* (see Wolf, 1980, 1987).

Monolopia congdonii (A. Gray) B. G. Baldwin, comb. nov. Basionym: *Eatonella congdonii* A. Gray, Proc. Amer. Acad. Arts 19: 20. 1883. *Lembertia congdonii* (A. Gray) Greene, Fl. Fran. 441. 1897. SYNTYPES: U.S.A. California: Tulare County, "Deer Creek," Mar. 1881, *J. W. Congdon 439* (GH); "southern part of the San Joaquin Valley," Mar. 1881, *C. C. Parry s.n.* (GH). [Rydberg (1914) cited the *Congdon* collection as type.]

Greene's removal from *Eatonella* A. Gray of *E. congdonii* (transferred to a new genus, *Lembertia* Greene) is upheld by phylogenetic evidence that (1) *E. nivea* (D. C. Eaton) A. Gray, the type species of *Eatonella*, is the sister group of *Hulsea* Torrey & A. Gray; and (2) *Lembertia* and *Monolopia* constitute a clade (Baldwin & Wessa, 1997, & unpublished). Johnson (1978) concluded from morphological, chromosomal, and distributional studies that *Lembertia* and *Monolopia* constitute a "monolopioid line" distinct from an "eriophylloid line" comprising *Eriophyllum*, *Pseudobahia*, and *Syntrichopappus*. Results from phylogenetic analyses of nuclear ribosomal DNA sequences (Baldwin & Wessa, unpublished) confirm Johnson's (1978) hypothesis and provide robust support for nested placement of *Lembertia* within *Monolopia* sensu Johnson (1978).

Like other species of *Monolopia* and unlike the closely related genera *Eriophyllum*, *Pseudobahia*, and *Syntrichopappus*, members of *M. congdonii* possess a small lobe opposite the ray-corolla lamina, black phyllary hairs, unequal hair cells on the distal surfaces of the cypselae, and a chromosome number that falls within the range of $2n = 10$ to 13 II (i.e., $2n = 11$ II) (Johnson, 1978). *Monolopia congdonii* and two of the four remaining species of *Monolopia*, i.e., *M. lanceolata* Nuttall and *M. stricta*

Crum, have broadly overlapping distributions in the southern San Joaquin Valley and adjacent valleys of the Inner South Coast Ranges of California (Johnson, 1978).

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New Combinations and New Genera in the North American Tarweeds (Compositae–Madiinae)

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ABSTRACT. New combinations and new genera for species in *Hemizonia* DC., *Madia* Molina, and *Raillardiopsis* Rydberg allow for a revised, practical taxonomy of Madiinae that better reflects phylogenetic relationships. Reinstatement of *Anisocarpus* Nuttall, *Centromadia* Greene, *Deinandra* Greene, and *Hemizonella* A. Gray, abandonment of *Raillardiopsis* Rydberg, and recognition of four new genera (*Carlquistia*, *Harmonia*, *Jensia*, *Kyhosia*) for tarweed lineages without available generic names result from changes in circumscription based on monophyletic groups.

Results of phylogenetic, biosystematic, and cytogenetic studies in Madiinae (Kyhos et al., 1990; Baldwin et al., 1991; Baldwin, 1992, 1993, 1996, unpublished; Carr et al., 1996) indicate that *Hemizonia* DC. sensu Keck (1959), *Madia* Molina sensu Keck (1959), and *Raillardiopsis* Rydberg are not monophyletic. *Hemizonia* sensu Keck (1959) comprises a minimum of three monophyletic groups that correspond to section *Centromadia* (Greene) D. D. Keck, section *Hemizonia*, and section *Madiomeris* Nuttall sensu Tanowitz (1982) plus the informal "Fruticosae" or "Zonamra" (cf. Clausen, 1951; Keck, 1959). *Madia* sensu Keck (1959), *Raillardiopsis*, and the monophyletic Hawaiian silversword alliance (*Argyroxiphium* DC., *Dubautia* Gaudichaud-Beaupré, *Wilkesia* A. Gray; see Carr, 1985) constitute a clade lacking a formal name (the "Madia" lineage in Baldwin, 1996) that is extremely heterogeneous and difficult to diagnose morphologically. The Hawaiian group comprises trees, shrubs, subshrubs, large rosette plants, mat plants, cushion plants, and vines that are strikingly divergent in morphological and ecological characteristics from the primarily Californian herbs in *Madia* sensu Keck (1959) and *Raillardiopsis* (see Carr, 1985; Baldwin & Robichaux, 1995; Baldwin, 1997). In addition to the distinctive Hawaiian lineage, a minimum of seven monophyletic groups can be reliably diagnosed from morphological and molecular data within the clade comprising *Madia* sensu Keck (1959), *Raillardiopsis*, and the silversword alliance.

Recognition at the generic level of each of the three lineages in *Hemizonia* sensu Keck (1959) and each of the seven lineages in the paraphyletic group comprising *Madia* sensu Keck (1959) plus *Raillardiopsis* in the traditional (only) sense results in a practical taxonomy that conforms to the criterion of monophyly (= holophyly) of taxa. The revision of *Madia* sensu Keck (1959) plus *Raillardiopsis* (hereafter, MADRAIL) also allows for continued generic distinction of the unusual Hawaiian species in the silversword alliance without maintaining non-monophyletic California tarweed genera. I realize that additional nomenclatural changes in the silversword alliance are necessary to achieve a taxonomy of the Hawaiian species that includes only monophyletic genera. The new combinations herein focus only on genera relevant to treatments in preparation for the *Flora of North America North of Mexico*.

REVISION OF MADRAIL

In my revised taxonomy of MADRAIL, *Madia* is restricted to an $x = 8$ lineage of radiate, epappose annuals with compressed or 3-angled ray cypselae, i.e., the informal section "Madia" sensu Keck (1959), minus *M. minima* (A. Gray) D. D. Keck. *Madia minima*, with obcompressed ray cypselae, falls outside *Madia*, as circumscribed here, and is returned to the monospecific genus *Hemizonella* A. Gray. All of the widespread, ruderal taxa of *Madia* sensu Keck (1959) fall within *Madia* in the new sense. *Madia* remains the most widely distributed genus of Madiinae, with species found across much of western North America, in Chile and Argentina, and (mostly naturalized) in other parts of the world.

Anisocarpus Nuttall is resurrected for a taxon comprising both perennial (sister) species in MADRAIL with $2n = 7$ II: *M. madioides* (Nuttall) Greene (= *A. madioides* Nuttall, the type species of *Anisocarpus*) and *R. scabrida* (Eastwood) Rydberg (= *A. scabridus* (Eastwood) B. G. Baldwin), the type species of *Raillardiopsis*. Members of *Anisocarpus* in the new sense are the only perennial herbs in Madiinae that combine well-distributed cauline

leaves, radiate heads, ellipsoid or spheric involucres, and yellow anthers.

Anisocarpus is a western North American genus found from southern California to southern British Columbia. The two species constituting the genus are allopatric and ecologically divergent. *Anisocarpus madioides* is found in understories of evergreen forests at low to mid elevations, primarily in the coast ranges and on the outer coast of California, Oregon, Washington, and British Columbia. In contrast, *A. scabridus* is restricted to metamorphic scree slopes at high elevations in the inner North Coast Ranges and southern Cascade Range in California.

Anisocarpus scabridus (Eastwood) B. G. Baldwin, comb. nov. Basionym: *Raillardella scabrida* Eastwood, Bull. Torrey Bot. Club 32: 216. 1905. *Raillardiopsis scabrida* (Eastwood) Rydberg, N. Amer. Fl. 34: 320. 1927. TYPE: U.S.A. California: Snow Mountain, 25 Aug. 1892, *K. Brandegee s.n.* (holotype, CAS).

Four new genera are erected for the remaining MADRAIL lineages. *Carlquistia,* for *Raillardiopsis muirii* (A. Gray) Rydberg ($2n = 8$ II), recognizes Sherwin Carlquist for his contributions on systematic anatomy in Madiinae, work that led him to determine that *Raillardella* A. Gray in the traditional sense (including *Raillardiopsis*) and the Hawaiian silversword alliance are tarweeds. *Harmonia, Jensia,* and *Kyhosia* recognize Harvey Monroe Hall, Jens Clausen, and Donald W. Kyhos for their contributions to Madiinae biosystematics across three successive generations of botanists. *Harmonia* corresponds to the lineage of four species of yellow-anthered, pappose annuals with $2n = 9$ II. *Jensia* encompasses two (sister) species of dark-anthered, pappose annuals with $2n = 8$ II. *Kyhosia* is a monospecific genus to which the montane perennial *Madia bolanderi* (A. Gray) A. Gray ($2n = 6$ II) is transferred.

Carlquistia B. G. Baldwin, gen. nov. TYPE: *Raillardella muirii* A. Gray, Bot. Calif. 1: 618. 1876. ≡ *Carlquistia muirii* (A. Gray) B. G. Baldwin.

A Madiinae ceteris differt characteribus conjuncte: habitu perenni, herbaceo; rhizomatibus lignosis; foliis caulinis, foliis proximalibus oppositis; capitulis discoidis; squamis papporum subulatis, ciliato-plumosis; $2n = 8$ II.

Perennials, clumped to mat-forming, white-hirsute to villous and glandular; rhizomes woody, loosely branched; aerial stems greenish yellow to dark purplish, sometimes woody at base, ascending to erect, leafy throughout, simple or branched, 7–54 cm high; leaves sessile, opposite from base to beyond middle of stem, alternate distally; blades green to gray-green, linear to lanceolate, mostly 9–42 mm long, entire, flat to strongly crisped-coiled, the apices acute; heads discoid, borne singly or in leafy, loosely corymbiform or rounded capitulescences; peduncles 0–8 cm long; "involucres" elliptic-campanulate, campanulate, or turbinate, 8–13 mm high; "phyllaries" (5) 7 to 16, uniseriate, green to purple, subequal; receptacles flat, setulose; "paleae" none; florets 7 to 29, bisexual, the corollas yellow, tubular, 6.5–10 mm long, constricted basally; anthers yellow; style branches hispidulous; cypselae black, terete, linear, straight or slightly curved at acute base, 4–7.5 mm long, covered with white, antrorse hairs; pappus of 9 to 17, purplish white to tawny, subulate scales 5–11 mm long, ciliate-plumose to tip; $2n = 8$ II.

Members of *Carlquistia* are the only rhizomatous perennial herbs in Madiinae with both well-distributed cauline leaves and discoid heads. As in other members of Madiinae with discoid heads, true phyllaries are absent—the bracts surrounding the florets and functioning as an involucre are homologous with receptacular bracts (Carlquist, 1959).

Distribution, ecology, and relationships. Carlquistia is restricted to granitic exposures and granitic alluvium of mid- to high-elevational montane habitats of the southern Sierra Nevada and Ventana Double Cone in the Santa Lucia Range of California. *Carlquistia* appears to be most closely related to *Madia,* which shares the common base chromosome number of $x = 8$ (Baldwin, 1996, & unpublished). Members of the two genera are so disparate in habit, capitular morphology, and ecology that treating them as congeners is impractical, i.e., would result in a group difficult to diagnose with macroscopic characteristics.

Carlquistia muirii (A. Gray) B. G. Baldwin, comb. nov. Basionym: *Raillardella muirii* A. Gray, Bot. Calif. 1: 618. 1876. *Raillardiopsis muirii* (A. Gray) Rydberg, N. Amer. Fl. 34: 320. 1927. TYPE: U.S.A. California: Sierra Nevada, "the station unknown," *J. Muir s.n.* (holotype, GH).

Harmonia B. G. Baldwin, gen. nov. TYPE: *Madia hallii* D. D. Keck, Madroño 3: 5. 1935. ≡ *Harmonia hallii* (D. D. Keck) B. G. Baldwin.

A Madiinae ceteris differt characteribus conjuncte: habitu annuo; capitulis radiatis; phyllariis omnibus ovario radii perfecte cingentibus, phyllariis omnibus hirsutis irregulariter, apicibus pilorum rectis; bracteis receptaculo-

rum in annulo inter flosculos radiorum et flosculos discorum, discretis vel unitis infirme; antheris luteis; cypselis radiorum teretibus vel compressis; squamis papporum ± subulatis, ciliato-plumosis; $2n = 9$ II.

Annuals; stems erect, often reddish purple, slender, to 2.7(–4) dm high, hirsute; leaves sessile, mostly cauline, evenly distributed or congested at bases of subumbelliform capitulescences, opposite in proximal half or at base, alternate distally; blades narrowly linear, entire or shallowly toothed, often revolute, mostly hirsute, eglandular or minutely stipitate-glandular, the glands black (or yellowish); capitulescences loosely corymbiform or rounded to subumbelliform, or heads borne singly; peduncles erect or reflexed, 1–60 mm long, minutely stipitate-glandular, the glands black (or yellowish); involucres obconic to obovoid, 3–6 mm high; phyllaries 3 to 8, uniseriate (1 per ray floret), herbaceous, each completely enveloping a ray ovary, not bulging downward at base, the apices acute to acuminate, <half the length of enfolded basal portion of phyllaries, flat or revolute; abaxial faces mostly sparsely to densely hirsute, often with broadly arching or somewhat appressed hairs, often sericeous to villous near margins, ciliate with soft hairs interlocking the enfolded margins, eglandular or minutely stipitate-glandular, the glands black (or yellowish); receptacles flat to slightly convex, glabrous or sparsely setulose; paleae not persistent, restricted to ring at periphery of receptacle (encircling the disc florets), the margins free or weakly fused; ray florets 3 to 8, pistillate, the corollas bright yellow, the laminae flabelliform to obovate, 3-lobed; disc florets 7 to 30, bisexual or functionally staminate, the corollas bright yellow, 5-lobed, glabrous or the tube sparsely villous; anthers yellow; style branches elongate, hispidulose; ray cypselae black, terete to compressed, faintly or prominently adaxially angled, clavate, kyphotic (i.e., strongly bowed out abaxially and slightly concave adaxially) or weakly arcuate, glabrous, beakless to distinctly beaked, attachment scar basal; ray pappus none or of rudimentary broad or subulate scales, ≤1 mm long, fimbriate to plumose; disc cypselae black, terete, clavate, straight or weakly arcuate, glabrous or with antrorse hairs; disc pappus of 7 to 10, stramineous or purplish, lance-attenuate to subulate, ± flat (not crisped), fimbriate or ciliate-plumose scales 0.2–4 mm long; $2n = 9$ II.

Members of *Harmonia* are the only annuals in Madiinae that combine yellow anthers, phyllaries each completely surrounding a ray ovary, terete to compressed ray cypselae, and pappose disc ovaries. Unlike *Jensia*, *Harmonia* has phyllaries irregularly hirsute and lacking uncinate hairs, receptacular bracts free or weakly fused, anthers yellow, pappus elements plane, and $2n = 9$ II.

Distribution, ecology, and relationships. *Harmonia* is restricted to soils derived from volcanic ash or serpentine in the North Coast Ranges and Klamath Ranges, California. The volcanic-ash endemic *H. nutans* is apparently sister to the remaining three, serpentine-endemic species (Baldwin, 1993, & unpublished).

Harmonia doris-nilesiae (T. W. Nelson & J. P. Nelson) B. G. Baldwin, comb. nov. Basionym: *Madia doris-nilesiae* T. W. Nelson & J. P. Nelson, Brittonia 37: 394. 1985. TYPE: U.S.A. California: Trinity County, along Shasta-Trinity Forest road 1N40, 0.25 mi. E of junction with road 1N35 (T1N, R7E, S2), 3600 ft., 14 June 1983, *T. W. Nelson & B. Williams 7422* (holotype, HSC; isotypes, CAS, JEPS; also GH, MO, NY, US, WTU, not seen).

Harmonia hallii (D. D. Keck) B. G. Baldwin, comb. nov. Basionym: *Madia hallii* D. D. Keck, Madroño 3: 5. 1935. TYPE: U.S.A. California: Napa County, "Near Knoxville," 27 May 1931, *H. M. Hall 13094* (holotype, DS; isotypes, UC; also B, CI, GH, K, MO, NY, US, not seen).

Harmonia nutans (Greene) B. G. Baldwin, comb. nov. Basionym: *Callichroa nutans* Greene, Pittonia 2: 227. 1892. *Blepharipappus nutans* Greene, Pittonia 2: 247. 1892. *Layia nutans* (Greene) Jepson, Fl. W. Mid. Calif., ed. 2. 449. 1911. *Madia nutans* (Greene) D. D. Keck, Madroño 3: 5. 1935. TYPE: U.S.A. California: Sonoma County, "Hood's Peak" (on label), 15 May 1892, *F. T. Bioletti s.n.* (holotype, NDG).

Harmonia stebbinsii (T. W. Nelson & J. P. Nelson) B. G. Baldwin, comb. nov. Basionym: *Madia stebbinsii* T. W. Nelson & J. P. Nelson, Brittonia 32: 323. 1980. TYPE: U.S.A. California: Trinity County, along Shasta-Trinity National Forest road to Hell-to-Find Lake (T29N, R11W, S27, NE1/4), 23 June 1978, *T. W. Nelson & J. P. Nelson 4337* (holotype, HSC; isotypes, CAS, DAV, JEPS, UC; also GH, MO, NY, RSA, US, WTU, not seen).

Jensia B. G. Baldwin, gen. nov. TYPE: *Madia yosemitana* Parry ex A. Gray, Proc. Amer. Acad. Arts 17: 219. 1882. ≡ *Jensia yosemitana* (Parry ex A. Gray) B. G. Baldwin.

A Madiinae ceteris differt characteribus conjuncte: habitu annuo; capitulis radiatis; phyllariis omnibus ovario radii perfecte cingentibus, phyllariis omnibus hirsutis ± uniformiter, apicibus pilorum uncinatis; bracteis receptaculorum in annulo inter flosculos radiorum et flosculos discorum, unitis valde; antheris purpureis; cypselis radiorum compressis; squamis papporum subulatis, crispis irregulariter, ciliatis; $2n = 8$ II.

Annuals; stems erect, stramineous to reddish purple, usually slender, to 6 dm tall, hirsute; leaves sessile, mostly cauline, evenly distributed or congested at bases of subumbelliform capitulescenses, opposite in proximal half or at base, alternate distally; blades linear to narrowly spatulate, entire or inconspicuously toothed, plane or slightly revolute, strigose or hirsute, eglandular or the distalmost minutely stipitate-glandular, the glands yellowish or reddish (or black); capitulescences loosely corymbiform or rounded to subumbelliform, or heads borne singly; peduncles erect, to at least 1 dm long, hirsute or not, eglandular or minutely stipitate-glandular, the glands yellowish or reddish or rarely black; involucres obconic to spheric, 3–5 mm high; phyllaries 2 to 10 in 1 series (1 per ray floret), herbaceous, each completely enveloping a ray ovary, usually bulging slightly downward at base, the apices acuminate, revolute, abaxial faces hirsute (the stout hairs usually uncinate at tips, often from pustules), usually eglandular, minutely farinose near margins, ciliate with soft hairs interlocking the enfolded margins; receptacles flat to slightly convex, glabrous or sparsely setulose; paleae not persistent, restricted to ring at periphery of receptacle (encircling the disc florets), ± strongly fused most of length; ray florets 2 to 10, pistillate, the corollas bright yellow, often with purplish lines on abaxial surface of laminae, the laminae obovate, 3-lobed; disc florets 1 to 65, functionally staminate, corollas bright yellow, 5-lobed, glabrous or nearly so; anthers dark purple; style branches elongate, hispidulose; cypselae black, compressed, adaxially angled, clavate, kyphotic, glabrous, distinctly beaked, attachment scar slightly oblique; ray pappus a minute crown of subulate scales, to 1 mm long; disc ovaries glabrous; disc pappus of 5 to 7, white or purplish tipped, subulate, crisped, ciliate scales 2.5–4 mm long; $2n = 8$ II.

Members of *Jensia* are the only annuals in Madiinae that combine phyllaries each completely surrounding a ray ovary, dark purple anthers, terete to compressed ray cypselae, and pappose disc ovaries. Unlike *Harmonia*, *Jensia* has phyllaries more or less uniformly hirsute with hairs usually uncinate, receptacular bracts strongly united, anthers dark purple, pappus elements crisped, and $2n = 8$ II.

Distribution and ecology. *Jensia* is found from foothill woodlands to mid-montane meadows in the western Sierra Nevada, California. The showy, self-incompatible *J. rammii* and the diminutive, self-compatible *J. yosemitana* are allopatric sister-species. *Jensia rammii* occurs in the Sierra foothills; *J. yosemitana* occurs in montane Sierran habitats.

Jensia rammii (Greene) B. G. Baldwin, comb. nov. Basionym: *Madia rammii* Greene, Bull. Calif. Acad. Sci. 1: 90. 1885. *Anisocarpus rammii* (Greene) Greene, Fl. Francisc. 415. 1897. TYPE: U.S.A. California: Nevada City, July 1884, *C. A. Ramm s.n.* (holotype, CAS).

Jensia yosemitana (Parry ex A. Gray) B. G. Baldwin, comb. nov. Basionym: *Madia yosemitana* Parry ex A. Gray, Proc. Amer. Acad. Arts 17: 219. 1882. *Anisocarpus yosemitana* (Parry ex A. Gray) Greene, Fl. Francisc. 416. 1897. TYPE: U.S.A. California: "foot of the Upper Yosemite Fall," June 1881, *C. C. Parry s.n.* (holotype, GH; isotype, DS).

Kyhosia B. G. Baldwin, gen. nov. TYPE: *Anisocarpus bolanderi* A. Gray, Proc. Amer. Acad. Arts 7: 360. 1868. ≡ *Kyhosia bolanderi* (A. Gray) B. G. Baldwin.

A Madiinae ceteris differt characteribus conjuncte: habitu perenni, rhizomatoso, herbaceo; capitulis radiatis; phyllariis omnibus ovario radii ± cingentibus; bracteis receptaculorum in annulo inter flosculos radiorum et flosculos discorum; antheris atropurpureis; squamis papporum ± subulatis, ciliatis; $2n = 6$ II.

Herbs, perennial, with acrid odor; stems erect, stramineous to reddish purple, usually robust, to 12 dm tall, sparsely to densely hirsute proximally, stipitate-glandular distally, the glands yellowish brown to black; leaves sessile, basal and cauline, congested near base, opposite from base to beyond middle of stem, alternate distally; blades linear or lance-linear, to 35 cm long, to 1.5 cm wide, the distal shorter and more widely spaced than on proximal stem, entire, sparsely to densely hirsute, the distalmost stipitate-glandular; capitulescences loosely corymbiform or rounded, usually of 8 or fewer heads; peduncles erect, to 15(–25) cm long, stipitate-glandular, the glands yellowish brown to black; involucres campanulate to hemispheric, 7–14 mm high; phyllaries 8 to 12, uniseriate (1 per ray floret), herbaceous, each ± completely enveloping a ray ovary, ciliate, often ± hirsute, coarsely

stipitate-glandular; phyllary apices acuminate, up to half the length of enfolded basal portion, revolute; receptacles convex, glabrous or sparsely setulose; paleae not persistent, mostly free or weakly united, restricted to ring encircling the disc florets at periphery of receptacle; ray florets 8 to 12, pistillate, the corollas bright yellow, the laminae conspicuous, oblanceolate to obovate, deeply 3-lobed, the tubes hirsute and minutely glandular; disc florets 30 to 65, bisexual, the corollas bright yellow, 5-lobed, sparsely hirsute and minutely glandular; anthers dark purple; style branches elongate, hispidulose; ray cypselae brown to black, ± terete, weakly 5-ridged (with adaxial angle evident), clavate, arcuate, about 5–7 mm long, glabrous or sparsely hispidulose, constricted apically, attachment scar basal; ray pappus absent or a minute crown of subulate scales; disc cypselae brown to black, terete, weakly 5-ridged, clavate, straight or arcuate proximally, ca. 5–9 mm long, brownish hispid (the hairs ascending); disc pappus of 5 to 10, stramineous or purplish, broadly lanceolate to subulate, ciliate to ciliate-plumose scales ca. 2–5 mm long; $2n = 6$ II.

Members of *Kyhosia* are the only rhizomatous perennial herbs in Madiinae that combine radiate heads, paleae restricted to a ring at the periphery of the receptacle, bisexual disc florets, and dark purple anthers.

Distribution and ecology. *Kyhosia* is endemic to the California Floristic Province, where it occurs in mid-montane wet meadows and on streambanks of the western Sierra Nevada and in the southern Cascade Range and Klamath Ranges of California and southern Oregon.

Kyhosia bolanderi (A. Gray) B. G. Baldwin, comb. nov. Basionym: *Anisocarpus bolanderi* A. Gray, Proc. Amer. Acad. Arts 7: 360. 1868. *Madia bolanderi* (A. Gray) A. Gray, Proc. Amer. Acad. Arts 8: 391. 1872. TYPE: U.S.A. California: "Mariposa Big-tree Grove," *H. N. Bolander s.n.* (holotype, GH; isotype, DS).

Revision of *Hemizonia* sensu Keck (1959)

Under my revised taxonomy for species in *Hemizonia* sensu Keck (1959), *Hemizonia* includes only the hayfield tarweeds, i.e., *H.* sect. *Hemizonia* sensu Keck (1959)—the *H. congesta* DC. (the type species of *Hemizonia*) complex. *Hemizonia* in the new sense comprises the annual members of Madiinae with receptacles chaffy throughout, disc florets functionally staminate, and cypselae without well-developed beaks. The hayfield tarweeds are endemic to seasonally dry, low- to mid-elevational habitats of the northern and central California Floristic Province, and are most diverse in the North Coast Ranges of California. Based on results of phylogenetic analyses, *Hemizonia* in the new sense is apparently most closely related to *Blepharizonia* Greene, also with $2n = 14$ II (Baldwin, unpublished).

Centromadia Greene is resurrected to accommodate the spikeweeds [*Hemizonia* sect. *Centromadia* sensu Keck (1935, 1959)], the only members of Madiinae with spine-tipped or apiculate leaves. Members of *Centromadia* are annual or rhizomatous-perennial herbs found in grassland or woodland habitats at low elevation, mostly in poorly drained, somewhat alkaline sites. The spikeweeds are endemic to the California Floristic Province; *C. pungens* subsp. *septentrionalis* has become naturalized in the interior Pacific Northwest of Oregon and Washington. New infraspecific combinations in *Centromadia* are provided below for practical convenience, prior to critical systematic re-evaluation of the infraspecific taxa.

Centromadia parryi (Greene) Greene subsp. **australis** (D. D. Keck) B. G. Baldwin, comb. nov. Basionym: *Hemizonia parryi* Greene subsp. *australis* D. D. Keck, Madroño 3: 15. 1935. *Hemizonia australis* (D. D. Keck) D. D. Keck, Aliso 4: 110. 1958. TYPE: U.S.A. California: Orange County, Seal Beach, 29 Sep. 1933, *D. D. Keck 2537* (holotype, DS; isotype, CAS).

Centromadia parryi (Greene) Greene subsp. **congdonii** (B. L. Robinson & Greenman) B. G. Baldwin, comb. nov. Basionym: *Hemizonia congdonii* B. L. Robinson & Greenman, Bot. Gaz. 22: 169. 1896. *Centromadia congdonii* (B. L. Robinson & Greenman) C. P. Smith, Muhlenbergia 4: 73. 1908. *Centromadia pungens* (Hooker & Arnott) Greene var. *congdonii* (B. L. Robinson & Greenman) Jepson, Man. Fl. Pl. Calif. 1087. 1925. *Hemizonia parryi* Greene subsp. *congdonii* (B. L. Robinson & Greenman) D. D. Keck, Madroño 3: 15. 1935. *Hemizonia parryi* Greene var. *congdonii* (B. L. Robinson & Greenman) Hoover, Fl. Vasc. Pl. San Luis Obispo Co., Calif. 288. 1970. TYPE: U.S.A. California: Monterey County, Salinas, 26 May 1886, *J. W. Congdon 151* (holotype, GH).

Centromadia parryi (Greene) Greene subsp. **rudis** (Greene) B. G. Baldwin, comb. nov. Basionym: *Centromadia rudis* Greene, Man. Bot. San Francisco 197. 1894. *Hemizonia parryi* Greene subsp. *rudis* (Greene) D. D. Keck, Madroño 3: 15. 1935. TYPE: U.S.A. California: Solano County, Vacaville, 20 Aug. 1892, *W. L. Jepson s.n.* (lectotype, selected here, NDG 61004; isolectotype, JEPS 38135). Three potential syntypes at NDG conform to Greene's protologue ("Sacramento Valley, near Vacaville, *Jepson*"). The date and locality of NDG 61004, annotated in D. D. Keck's handwriting as the type, are the same as on JEPS 38135, annotated in Jepson's handwriting as "part of original collection."

Centromadia pungens (Hooker & Arnott) Greene subsp. **laevis** (D. D. Keck) B. G. Baldwin, comb. nov. Basionym: *Hemizonia pungens* (Hooker & Arnott) Torrey & A. Gray subsp. *laevis* D. D. Keck, Madroño 3: 14. 1935. *Hemizonia laevis* (D. D. Keck) D. D. Keck, Aliso 4: 110. 1958. TYPE: U.S.A. California: San Bernardino Valley, 300 m, 8 July 1916, *S. B. Parish 10972* (holotype, DS; isotype, CAS).

Centromadia pungens (Hooker & Arnott) Greene subsp. **maritima** (Greene) B. G. Baldwin, comb. nov. Basionym: *Centromadia maritima* Greene, Man. Bot. San Francisco 196. 1894. *Hemizonia pungens* (Hooker & Arnott) Torrey & A. Gray subsp. *maritima* (Greene) D. D. Keck, Aliso 4: 110. 1958. TYPE: U.S.A. California: "Alameda," Oct. 1881, *E. L. Greene s.n.* (lectotype, selected here, NDG 61021). Two potential syntypes at NDG, both from "Alameda," conform to Greene's protologue ("Borders of salt marshes about San Francisco Bay," no date or collector indicated). The collection selected here as lectotype was annotated as the apparent type by D. D. Keck.

Centromadia pungens (Hooker & Arnott) Greene subsp. **septentrionalis** (D. D. Keck) B. G. Baldwin, comb. nov. Basionym: *Hemizonia pungens* (Hooker & Arnott) Torrey & A. Gray subsp. *septentrionalis* D. D. Keck, Aliso 4: 110. 1958. *Hemizonia pungens* (Hooker & Arnott) Torrey & A. Gray var. *septentrionalis* (D. D. Keck) Cronquist, Fl. Pacific Northwest 529. 1973. TYPE: U.S.A. California: Siskiyou County, Shasta Valley, *H. M. Hall 12907* (holotype, DS; isotype, DS).

Deinandra Greene is reinstated to accommodate the species in *Hemizonia* sect. *Madiomeris* sensu Tanowitz (1982) plus the informal "Fruticosae" or "Zonamra" (see Clausen, 1951; Keck, 1959). Members of *Deinandra* in the new sense are the only annuals, and non-rhizomatous perennials in Madiinae that combine phyllaries each about half-enclosing a ray ovary, receptacular bracts usually restricted to a peripheral ring, yellow ray corollas, beaked ray cypselae, and leaves lacking apical spines or large tack or pit glands. The names *Deinandra* Greene [type: *D. fasciculata* (DC.) Greene] and *Zonanthemis* Greene [type: *Z. corymbosa* (DC.) Greene, designated by Tanowitz (1982)] were published simultaneously. Their types fall within *H.* sect. *Madiomeris* sensu Tanowitz (1982); both names are available at the generic rank for the taxon comprising *H.* sect. *Madiomeris* sensu Tanowitz (1982) plus "Fruticosae" or "Zonamra" [the older generic name *Hartmannia* DC. is a later homonym of *Hartmannia* Spach]. I have chosen to use *Deinandra* to minimize the number of new combinations necessary to institute the revised taxonomy of *Hemizonia* sensu Keck (1959). New infraspecific combinations in *Deinandra* are provided for practical convenience, prior to critical systematic re-evaluation of the infraspecific taxa.

Deinandra in the new sense is nearly endemic to the California Floristic Province, with the exceptions of one species in the San Benito Islands of central Baja California (*D. streetsii*) and two species in the Mojave Desert of California (*D. arida* and *D. mohavensis*). Members of *Deinandra* usually occur in exposed, low- to mid-elevational habitats, mostly in seasonally dry sites. Based on results of phylogenetic analyses, *Deinandra* is apparently more closely related to the distinctive and reproductively isolated genus *Holocarpha* Greene than to the spikeweeds (*Centromadia*) (Baldwin, unpublished), despite crossability and partial interfertility between some members of *Centromadia* and *Deinandra* (Clausen, 1951; Tanowitz, 1977).

Deinandra arida (D. D. Keck) B. G. Baldwin, comb. nov. Basionym: *Hemizonia arida* D. D. Keck, Aliso 4: 109. 1958. TYPE: U.S.A. California: Kern County, Mojave Desert, mouth of Red Rock Canyon, 2300 ft., 11 May 1935, *D. D. Keck & P. Stockwell 3279* (holotype, DS; isotypes, CAS, UC; also ARIZ, B, BKL, BM, BR, BRY, C, CAN, CI, COLO, CU, E, F, G, GH, HEL, IA, ILL, IND, K, L, LA, LD, MICH, MIN, MO, MT, NY, OC, OKL, ORE, OS, OSC, P, PENN, PH, POM, RM, S, SBBG, TEX, U, UPS, US, UTC, WIS, WS, WTU, not seen).

Deinandra clementina (Brandegee) B. G. Baldwin, comb. nov. Basionym: *Hemizonia clementina* Brandegee, Erythea 7: 70. 1899. *Zonanthemis clementina* (Brandegee) Davidson & Moxley, Fl. S. Calif. 401. 1923. TYPE: U.S.A. California: San Clemente Island, 25 Aug. 1894, *T. S. Brandegee s.n.* (lectotype, selected here, UC 174175). Type not designated by Brandegee.

Deinandra conjugens (D. D. Keck) B. G. Baldwin, comb. nov. Basionym: *Hemizonia conjugens* D. D. Keck, Aliso 4: 109. 1958. TYPE: U.S.A. California: San Diego County, "river bottom land near Otay," 16 May 1903, *L. Abrams 3521* (holotype, UC 407335; isotypes, CAS; also NY, POM, not seen).

Deinandra corymbosa (DC.) B. G. Baldwin, comb. nov. Basionym: *Hartmannia corymbosa* DC., Prodr. 5: 694. 1836. *Hemizonia corymbosa* (DC.) Torrey & A. Gray, Fl. N. Amer. 2: 398. 1843. *Zonanthemis corymbosa* (DC.) Greene, Fl. Fran. 425. 1897. TYPE: U.S.A. California: "Nova California," 1833, *Douglas 2* (holotype, G-DC not seen; photograph and fragments, UC; isotypes [fide Tanowitz (1982)], BM, K, not seen).

Deinandra corymbosa (DC.) B. G. Baldwin subsp. **macrocephala** (Nuttall) B. G. Baldwin, comb. nov. Basionym: *Hemizonia macrocephala* Nuttall, J. Acad. Nat. Sci. Philadelphia II 1: 175. 1848. *Hemizonia angustifolia* DC. subsp. *macrocephala* (Nuttall) D. D. Keck, Madroño 3: 12. 1935. *Hemizonia corymbosa* (DC.) Torrey & A. Gray subsp. *macrocephala* (Nuttall) D. D. Keck, Aliso 4: 109. 1958. TYPE: U.S.A. California: "At St. Simeon, Upper California," *W. Gambel* (holotype, PH not seen). Tanowitz (1982), who reported seeing the type, indicated the type locality as "in the vicinity of Monterey" and the collector as Nuttall.

Deinandra frutescens (A. Gray) B. G. Baldwin, comb. nov. Basionym: *Hemizonia frutescens* A. Gray, Proc. Amer. Acad. Arts 11: 79. 1876. TYPE: Mexico. Baja California: "the interior of Guadalupe Island," 1875, *E. Palmer s.n.* (holotype, GH).

Deinandra greeneana (Rose) B. G. Baldwin, comb. nov. Basionym: *Hemizonia greeneana* Rose, Contr. U.S. Natl. Herb. 1: 24. 1890. TYPE: Mexico. Baja California: Guadalupe Island, "south end" (on label), 29 Mar. 1889, *E. Palmer 865* (holotype, US; isotype, CAS).

Deinandra greeneana (Rose) B. G. Baldwin subsp. **peninsularis** (Moran) B. G. Baldwin, comb. nov. Basionym: *Hemizonia greeneana* Rose subsp. *peninsularis* Moran, Trans. San Diego Soc. Nat. Hist. 15: 286. 1969. *Hemizonia greeneana* Rose var. *peninsularis* (Moran) B. L. Turner, Phytologia 69: 15. 1990. TYPE: Mexico. Baja California: Punta Banda, Banda Peak, 27 Aug. 1966, *Moran 13437* (holotype, SD not seen; isotypes, CAS, UC; also K, MEXU, US, "etc.," not seen).

Deinandra halliana (D. D. Keck) B. G. Baldwin, comb. nov. Basionym: *Hemizonia halliana* D. D. Keck, Madroño 3: 12. 1935. TYPE: U.S.A. California: San Luis Obispo County, 1.5 mi. E of Cholame, dry flood plain of Cholame Creek, 1200 ft., 4 May 1933, *D. D. Keck & W. M. Heusi 2170* (holotype, DS; isotypes, DS, UC; also [fide Tanowitz (1982)] MO, NY, US, not seen).

Deinandra increscens (H. M. Hall ex D. D. Keck) B. G. Baldwin, comb. nov. Basionym: *Hemizonia paniculata* A. Gray subsp. *increscens* H. M. Hall ex D. D. Keck, Madroño 3: 11. 1935. *Hemizonia increscens* (H. M. Hall ex D. D. Keck) Tanowitz, Syst. Bot. 7: 328. 1982. TYPE: U.S.A. California: San Luis Obispo County, 7.5 mi. SW of Arroyo Grande, 7 June 1931, *H. M. Hall 13136* (holotype, DS; isotype, DS).

Deinandra increscens (H. M. Hall ex D. D. Keck) B. G. Baldwin subsp. **foliosa** (Hoover) B. G. Baldwin, comb. nov. Basionym: *Hemizonia paniculata* A. Gray subsp. *foliosa* Hoover, Fl. Vasc. Pl. San Luis Obispo Co., Calif. 288. 1970. *Hemizonia increscens* (H. M. Hall ex D. D. Keck) Tanowitz subsp. *foliosa* (Hoover) Tanowitz, Syst. Bot. 7: 330. 1982. TYPE: U.S.A. California: San Luis Obispo County, sand hills N of Pozo, 6 Oct. 1965, *Hoover 9715* (lectotype, designated by Tanowitz (1982), OBI not seen; isolectotypes, CAS, UC; also OBI, RSA, not seen).

Deinandra increscens (H. M. Hall ex D. D. Keck) B. G. Baldwin subsp. **villosa** (Tanowitz) B. G. Baldwin, comb. nov. Basionym: *Hemizonia increscens* (H. M. Hall ex D. D. Keck) Tanowitz subsp. *villosa* Tanowitz, Syst. Bot. 7: 331. 1982. TYPE: U.S.A. California: Santa Barbara County, Gaviota, *Tanowitz 1650* (holotype, UCSB; isotypes (2), JEPS).

Deinandra martirensis (D. D. Keck) B. G. Baldwin, comb. nov. Basionym: *Hemizonia martirensis* D. D. Keck, Madroño 3: 12. 1935. TYPE: Mexico. Baja California: 25 mi. E of San Telmo, in immediate vicinity of San Jose, foothill region at base of San Pedro Martir Mountains, 23 Feb. 1931, *A. Meling 2* (holotype, DS; isotypes, DS, UC; also [fide Tanowitz (1982)] C, GH, US, not seen).

Deinandra minthornii (Jepson) B. G. Baldwin, comb. nov. Basionym: *Hemizonia minthornii* Jepson, Man. Fl. Pl. Calif. 1092. 1925. TYPE: U.S.A. California: Ventura County, Santa Susana Mountains, 15 Nov. 1923, *T. W. Minthorn s.n.* (holotype, JEPS 2628).

Deinandra mohavensis (D. D. Keck) B. G. Baldwin, comb. nov. Basionym: *Hemizonia mohavensis* D. D. Keck, Madroño 3: 9. 1935. TYPE: U.S.A. California: San Bernardino County, "Mohave River, at confluence with Deep Creek, Mohave Desert," 900 m, 17 Sep. 1933, *D. D. Keck 2531* (holotype, DS; isotype, DS).

Deinandra pallida (D. D. Keck) B. G. Baldwin, comb. nov. Basionym: *Hemizonia pallida* D. D. Keck, Madroño 3: 8. 1935. TYPE: U.S.A. California: Kern County, 5.3 mi. N of Grapevine, "Head of the San Joaquin Valley," 6 May 1933, *D. D. Keck & W. M. Heusi 2255* (holotype, DS; isotypes, CAS, UC; also B, C, FM, GH, K, MO, NY, PH, POM, US, not seen).

Deinandra palmeri (Rose) B. G. Baldwin, comb. nov. Basionym: *Hemizonia palmeri* Rose, Contr. U.S. Natl. Herb. 1: 24. 1890. TYPE: Mexico. Baja California: Guadalupe Island, Mar. 1889, *E. Palmer 874* (holotype, US).

Deinandra pentactis (D. D. Keck) B. G. Baldwin, comb. nov. Basionym: *Hemizonia lobbii* Greene subsp. *pentactis* D. D. Keck, Madroño 3: 8. 1935. *Hemizonia pentactis* (D. D. Keck) D. D. Keck, Aliso 4: 109. 1958. TYPE: U.S.A. California: San Luis Obispo County, "East side of the Salinas River, opposite San Miguel," 27 Apr. 1934, *D. D. Keck & J. Clausen 2836* (holotype, DS; isotypes, DS; also GH, K, not seen).

Deinandra streetsii (A. Gray) B. G. Baldwin, comb. nov. Basionym: *Hemizonia streetsii* A. Gray, Proc. Amer. Acad. Arts 12: 162. 1877. TYPE: Mexico. Baja California: "San Benito Island," *T. H. Streets* (holotype, GH).

The following key institutes a new taxonomy of Madiinae. The key was constructed for convenience of identification rather than to reflect phylogenetic relationships and does not list all distinguishing characteristics of the taxa or groups of taxa.

KEY TO GENERA OF MADIINAE

1a. Ray cypselae strongly obcompressed; if rays lacking, plants pappose annuals.
  2a. Disc florets 1(–2); minute annuals . . . . . *Hemizonella* A. Gray
  2b. Disc florets 3 or more; annuals or perennials.
    3a. Plants rhizomatous perennials . . . . . *Holozonia* Greene
    3b. Plants annuals.
      4a. Pappi of 10 broad, apically obtuse scales . . . . . *Achyrachaena* Schauer
      4b. Pappi absent or of elements with acute apex.
        5a. Heads calyculate; ray florets 5; disc florets 6, functionally staminate; disc pappus absent . . . . . *Lagophylla* Nuttall
        5b. Heads not calyculate; ray florets 0 or 3–27; disc florets 5–100+, bisexual; disc pappi usually present . . . . . *Layia* Hooker & Arnott
1b. Ray cypselae compressed or ± terete or somewhat triangular in cross section; if rays lacking, plants perennials or epappose annuals.
  6a. Styles of disc florets hairy proximal to minute branches; annuals . . . . . *Blepharipappus* Hooker
  6b. Styles of disc florets glabrous proximal to branches; annuals or perennials.
    7a. Plants perennial herbs, ± scapose; disc pappi of ciliate-plumose, subulate scales . . . . . *Raillardella* A. Gray
    7b. Plants annuals, leafy-stemmed perennial herbs, perennial rosette plants, or of woody growth form; disc pappi absent or various.

8a. Heads radiate or discoid; each ray cypsela usually compressed (to 3-angled with broad, rounded abaxial surface) and completely or mostly enclosed within a phyllary (if ray cypsela terete with phyllary only enclosing abaxial surface of cypsela, plants high-montane annuals or perennials).
9a. Plants woody or semi-woody, evergreen; Hawaiian.
10a. Ray florets present; rosette plants . . . . . *Argyroxiphium* DC.
10b. Ray florets absent; habits various.
11a. Leaves 1–4 per node, free or weakly united; trees, (sub)shrubs, mat-plants, cushion-plants, vines . . . . . *Dubautia* Gaudichaud-Beaupré
11b. Leaves 5 or more per node, strongly coalescent at base; rosette plants . . . . . *Wilkesia* A. Gray
9b. Plants herbaceous (aerial stems rarely semi-woody), seasonal; North American or South American.
12a. Disc pappi absent . . . . . *Madia* Molina
12b. Disc pappi present.
13a. Heads all discoid . . . . . *Carlquistia* B. G. Baldwin
13b. Heads radiate on at least part of plant.
14a. Plants perennials.
15a. Involucres campanulate to hemispheric; anthers dark purple . . . . . *Kyhosia* B. G. Baldwin
15b. Involucres elliptic or rounded in silhouette; anthers yellow . . . . . *Anisocarpus* Nuttall
14b. Plants annuals.
16a. Anthers yellow . . . . . *Harmonia* B. G. Baldwin
16b. Anthers dark purple . . . . . *Jensia* B. G. Baldwin

8b. Heads radiate; each ray cypsela terete to slightly obcompressed with adaxial surface flattened, slightly bulging, or low-keeled and only abaxial surface enclosed within a phyllary; plants low- to mid-elevation annuals, perennial herbs, and (sub)shrubs.
17a. Annuals; leaves filiform to narrowly linear and often strongly revolute; mostly with tack glands; ray corolla lobes often more than half the total length of the limb, the lateral lobes often spreading.
18a. Ray cypselae beaked; tack glands absent . . . . . *Osmadenia* Nuttall
18b. Ray cypselae not beaked; tack glands present . . . . . *Calycadenia* DC.
17b. Annuals, perennial herbs, or (sub)shrubs; leaves linear or broader and usually not strongly revolute; mostly without tack glands; ray corolla lobes usually less than half the total length of the limb, the lobes ± parallel.
19a. Ray cypselae not beaked; corollas white or, less commonly, yellow.
20a. Disc florets bisexual; ray and disc cypselae hairy, often with pappus . . . . . *Blepharizonia* Greene
20b. Disc florets functionally staminate; ray cypselae glabrous, without pappus . . . . . *Hemizonia* DC.
19b. Ray cypselae beaked; corollas yellow.
21a. Leaves each with an apical spine . . . . . *Centromadia* Greene
21b. Leaves each without an apical spine.
22a. Bracts each with large apical pit gland; receptacles with paleae throughout . . . . . *Holocarpha* (DC.) Greene
22b. Bracts without large pit glands; receptacles with paleae usually restricted to bases of outermost disc florets . . . . . *Deinandra* Greene

Acknowledgments. I thank Gerald D. Carr, David J. Keil, and John L. Strother for helpful reviews of the manuscript; JLS for his advice and encouragement during the study; JLS and Alan R. Smith for assistance with the Latin diagnoses; and Victoria C. Hollowell and Roy Gereau for careful editing of the paper. I also thank the curators of GH, HSC, NDG, and US for loans. This paper is based on research supported by the National Science Foundation (DEB-9458237), and by Roderick Park and other generous Friends of the Jepson Herbarium.

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A New Species of *Tapirira* (Anacardiaceae) from Ecuador

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ABSTRACT. *Tapirira rubrinervis* Barfod, sp. nov., is described from the coastal plain of Ecuador. It is easily distinguished from its congeners by the few-foliolate leaves, the obovate, unequally sized leaflets, and the striking red venation of the lower surfaces of the leaflets. The variation in leaf morphology and phenology is discussed.

RESUMEN. Se describe una especie nueva, *Tapirira rubrinervis* Barfod, de la región costera de Ecuador. Se distingue fácilmente de sus congéneres por tener las hojas con pocos folíolos, los folíolos desiguales y obovados, con llamativa nervadura roja del envés. Asimismo, se comenta la variación en la morfología de las hojas y su fenología.

A recent revision of Ecuadorian Anacardiaceae for the *Catalogue of the Vascular Plants of Ecuador* (Jørgensen & León-Yánez, 1999) revealed a new species of *Tapirira*. Barfod (1987) described only two species of *Tapirira* in *Flora of Ecuador*: *Tapirira guianensis* Aublet, with two subspecies (Barfod, 1986), and *T. peckoltiana* Engler, which should be correctly named *T. obtusa* (Bentham) J. D. Mitchell (Mitchell, 1993). Since this flora treatment was published, *T. guianensis* has been recorded several times west of the Andes in the provinces of Esmeraldas and Carchi, Ecuador. It has been found on the northern coastal plain along the upper tributaries of the Cayapas and Mira rivers. In the Cayapas river system, it is locally known as "sajo de arriba," or "sajo chi." "Sajo" is the name for *Campnosperma panamense* Standley, a rare simple-leaved species of Anacardiaceae growing near Borbón (Little & Dixon, 1969).

In 1993, I received for the first time material of an undescribed species of *Tapirira* growing along the Mira River and its tributaries in the province of Carchi, where it is locally known as "cuilde." The congener *T. guianensis* also occurs in that area. It is called "cuilde blanco." There was little doubt that the new material represented a separate species, and it is described here based on nine collections. Although it has several very distinctive features, it is probably most closely related to *Tapirira guianensis*. Like this species it has chartaceous leaflets that are inconspicuously hairy beneath or glabrous. The flowers are typical for the genus.

KEY TO ECUADOREAN SPECIES OF *TAPIRIRA*

1a. Leaves (1–)3–5 foliolate, obovate, rounded apically, glabrous, venation bright red beneath . . . . . *T. rubrinervis* Barfod
1b. Leaves 5–15 foliolate, ovate to elliptic, rarely oblong, acuminate, with hairs beneath, venation brown or green.
  2a. Leaflets with adpressed hairs beneath or glabrous.
    3a. Leaflets chartaceous, adpressed-pubescent beneath; sepals less than 0.4 mm long, petals 1.5–2 mm, venation usually inconspicuous; disc ca. 1 mm diam . . . . *T. guianensis* Aublet subsp. *guianensis*
    3b. Leaflets subcoriaceous, sparsely adpressed-pubescent to glabrous beneath; sepals more than 0.5 mm long, petals 2–2.5 mm, venation conspicuous; disc 1.5–2 mm diam . . . . . *T. guianensis* Aublet subsp. *subandina* Barfod & Holm-Nielsen
  2b. Leaflets densely tomentose pilose to velutinous beneath . . . . . *T. obtusa* (Bentham) J. D. Mitchell (syn. *T. peckoltiana* Engler)

Tapirira rubrinervis Barfod, sp. nov. TYPE: Ecuador. Carchi: border area with Prov. of Esmeraldas, km 20 on Lita–Alto Tambo road, 550 m, 25 June 1991 (fl), *H. van der Werff, B. Gray & G. Tipaz 11971* (holotype, AAU; isotypes, MO, QCA). Figure 1.

A congeneris ceteris differt foliis paucifoliolatis, foliolis statura inaequale, obovatis, glabris. Nervatio foliorum infra conspicue rubra.

Evergreen trees to 30 m tall and 65 cm DBH. Bark unknown. Branchlets with deciduous ferrugineous feltlike pubescence, lenticels irregularly distributed, abundant on young portions, unevenly sized, rounded; leaf-bearing twigs hollow in dried condition with minute longitudinal ridges. Leaves imparipinnate, (1–)3–5 foliolate, the number of leaflets per leaf apparently decreasing toward the tip of the branches, the distal leaves being trifoliolate or simple (unifoliolate) (*Tipaz et al. 1031*); petiole

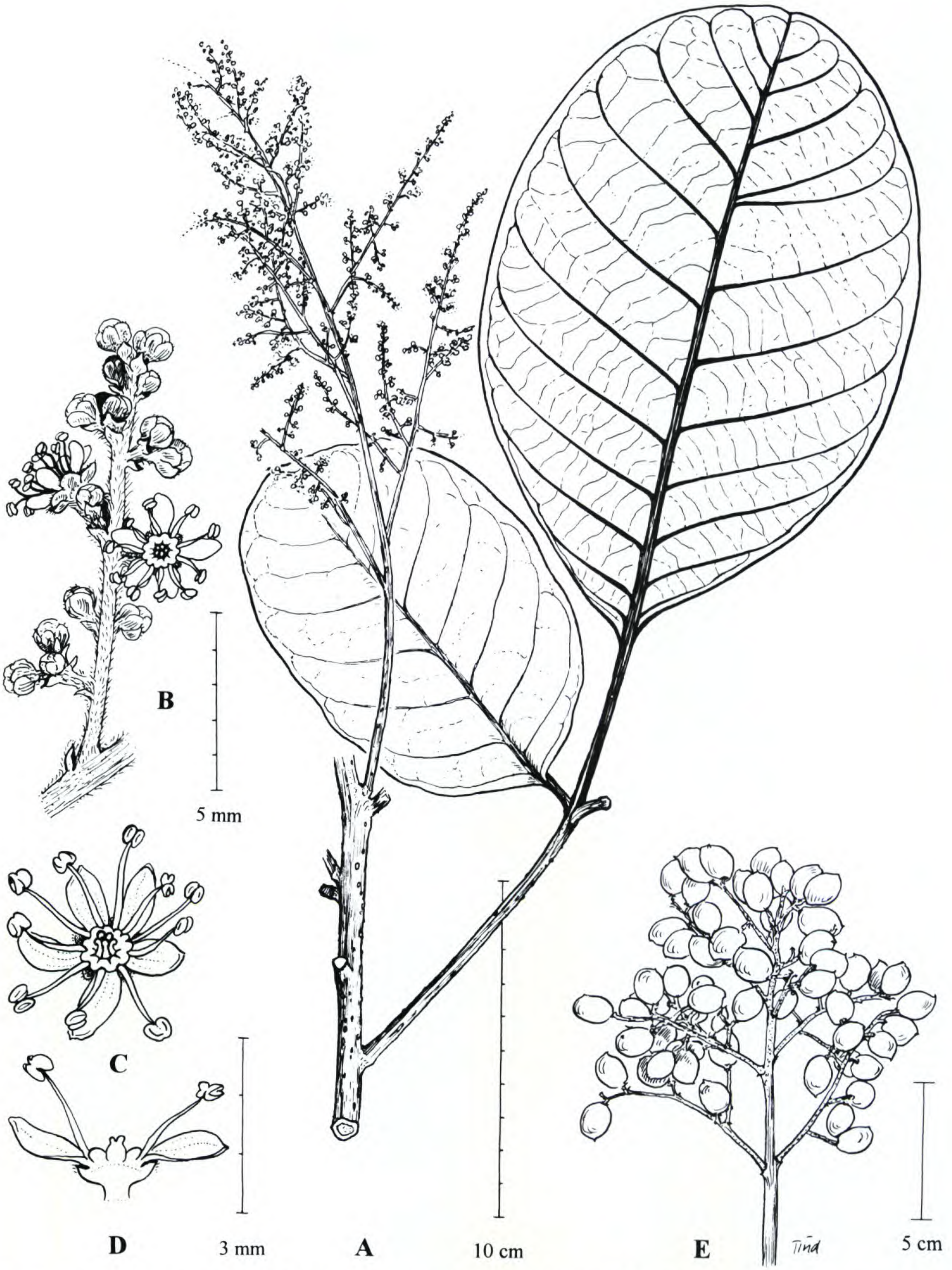

Figure 1. *Tapirira rubrinervis* Barfod. —A. Flowering branch. —B. Distal floral branch. —C. Flower at staminate anthesis. —D. Longitudinal section of C. —E. Infructescence. (A–D based on *van der Werff et al. 11971*; E based on *Tipaz et al. 1339*.)

(5–)8–12(–16) cm long, rachis to 15 cm long in the 7-foliolate leaves, both rachis and petiole glabrous, brown to ferrugineous, terete, with lens-shaped lenticels and fine longitudinal ridges; leaflets opposite, lateral petiolules 5–10 mm, terminal petiolule up to 8 cm long, glabrous, with dorsal furrow from attenuated leaf base; leaflets markedly different in size, the proximal ones (if present) smallest, 6–8 × 4–5 cm, the terminal one largest up to 25 × 14 cm, elliptic to obovate, chartaceous in dried condition, lustrous green, glabrous to minutely puberulent above, smooth matte green below, margin entire, subrevolute, apex rounded to obtuse (rarely with short acumen), base obtuse to rounded, oblique, shortly attenuate; venation brochidodrome pinnate, midvein prominulent often in groove above, very prominent and red beneath, secondary veins oppposite to alternate, prominulent above, prominent and red below, veinlets only clearly visible and somewhat impressed below. Inflorescence paniculate, arising in the axils of new leaves and grouped at a subterminal position, at anthesis usually superseded by juvenile leaves at the distal nodes, decreasing in size and degree of development toward the tip of the branch, the proximal lateral inflorescence being up to 40 cm long at anthesis, slightly curved, with peduncle to 14 cm long, all axes with ferrugineous pubescence varying in density, flowers typically borne in congested groups of three on short monopodial flower-bearing branches, each subtended by deltoid bracts ca. 0.5 mm long, floral bracts conspicuous, 0.3–0.5 mm long, often rounded apically, bracteoles inconspicuous to conspicuous on single lateral flowers toward the distal end of the flower-bearing branches, inserted immediately below the abscission zone. Flowers at staminate anthesis subsessile, rarely with pedicel up to 1 mm, sepals 5, 0.7–0.8 × 0.7–0.8 mm, rounded, with sparse pubescence on abaxial faces, marginally ciliate; petals 5, 1.5–1.8 × 0.7–0.9 mm, ovate to elliptic, with visible venation in dried condition, reflexed; stamens 10, of unequal length up to 2 mm long, filaments slender, subulate, anthers 0.2–0.4 mm long, rounded; disc about 1.0 mm wide, 10-crenulate; rudimentary pistil 0.5–0.6 mm long, tomentose to pilose; ovary partly sunken in disc; styles 5, straight to slightly recurving; stigmas discoid. Flowers at late pistillate anthesis with developing pistil not available. Green fruits up to 10 mm long, some with wilted, 0.8–1.0-mm-long stamens at the base, apparently with aborted thecae. Mature fruits not seen.

Leaf morphology. The leaves are few-foliolate, typically trifoliolate. From the material, it appears that trees with 5-foliolate leaves are common. One specimen (*Tipaz et al. 1031*) has simple (unifoliolate) leaves, at least toward the tips of the inflorescence-bearing branches.

Phenology. The sexual expression within *Tapirira* needs to be studied in detail before any conclusions can be drawn. As interpreted here, *T. rubrinervis* is functionally dioecious like other species of *Tapirira*. However, most of the material examined is in bud and difficult to determine to sex. Fully open flowers with reflexed petals and unequal stamens, to 2 mm long, were only found in *Quelal 647* and *van der Werff et al. 11971*. The anthers are past dehiscence, and a large proportion of the pollen grains has germinated.

In other specimens, e.g., *Aulestia 1257*, *Tipaz et al. 1339*, and *Mendez et al. 400*, flowers have just opened. These are generally smaller than the fully opened flowers described above, with petals 1.2–1.3 mm long and stamens of equal length. The filaments are only 0.3–0.4 mm long and the anthers rounded. These are interpreted as functionally staminate flowers at early anthesis. Aberrant pollen grains were not observed, and the gynoecium was very similar to that of the long-staminate flowers, except for being a little smaller. It should be noted that in the material examined, I did not see pistillate flowers with developing, fertilized gynoecia.

Fruiting material of *Tapirira rubrinervis* was long past anthesis and gave few indications of the morphology of the assumed pistillate flower. Only the 0.8–1.0-mm-long, wilted stamens suggest that the flowers are different in proportions from their staminate homologues.

Based on this limited evidence, it cannot be excluded that *Taprira rubrinervis* has hermaphroditic flowers with sexual expression separated temporally but not spatially. This seems unlikely, since all other species of *Tapirira* are known as functionally dioecious or polygamodioecious.

Common name. "Sajo de arriba" (Esmeraldas), "Cuilde" (Carchi).

Use. Fibers are extracted from this species according to *Quelal et al. 267*. What they are used for is not specified, however. The fruits are eaten by several birds in the area.

Distribution. *Tapirira rubrinervis* is only known from the province of Carchi in Ecuador.

Paratypes. ECUADOR. **Carchi:** border area between Prov. Carchi and Esmeraldas, km 20 Lita–Alto Tambo road, 700 m, 23 June 1991 (fr), *H. van der Werff, B. Gray & G. Tipaz 11894* (AAU, MO, QCA, QCNE); Parroquia Tobar Donoso, Reserva indígena Awá, bosque primario noreste de la casa comunal, cerca de Río Botella, 78°24′W, 1°0′N, 650–1000 m, 19–28 June 1992 (fr), *G. Tipaz, J. Zuleta & N. Guanga 1339* (AAU, MO, QCA, QCNE); Parroquia Chical, Gualpi Medio, Reserva Indí-

gena Awá, Sendero a San Marcos al norte de la casa communal, 23–27 May 1992 (fl, bud and early anthesis), *G. Tipaz, C. Quelal & G. Cantincuz 1031* (AAU, MO, QCA, QCNE); Chical, Reserva etnica Awá–Camumbí, 78°16′W, 0°53′N, 1700–1900 m, 20–29 July 1991 (fr), *C. Quelal, C. Aulestia & F. Nastacuáz 267* (AAU, MO, QCA, QCNE); Comunidad de Gualpi Medio, 78°16′W, 1°1′N, 900 m, 21 May 1992 (fl, staminate anthesis), *C. Quelal, G. Tipaz & J. Taicuz 647* (AAU, MO, QCA, QCNE); San Marcos de los Coaiqueres and surrounding perhumid forest on trail Chical–Tobar Donoso, 78°16′W, 1°6′N, 800 m, 8 Feb. 1985 (fl, bud). *B. Øllgaard, J. Korning, K. Thomsen & T. Illum 57652* (AAU, MO, QCA); Parroquia Alto Tambo, la Unión, Reserva etnica Awá, 78°26′W, 00°52′N, 250 m 22 Mar. 1993 (fl, bud and early anthesis), *C. Aulestia & M. Aulestia 1259* (AAU, MO, NY, QCA, QCNE); Parroquia el Chical, San Marcos, 78°14′W, 01°06′N, 900–1100 m, 20–30 Apr. 1993 (fl, bud and early anthesis), *P. Méndez, J. Aulestia & J. Pai 400* (AAU, MO, NY, QCA, QCNE).

Acknowledgments. The Latin diagnosis was kindly checked by Benjamin Øllgaard. Kirsten Tind rendered the line drawing. Manuel Macia helped write the Spanish abstract.

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A New Species of *Gibsoniothamnus* (Schlegeliaceae) from Costa Rica and Panama

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ABSTRACT. A new species, *Gibsoniothamnus parvifolius*, is described based on disjunct populations from Costa Rica and western Panama. The species is distinguished by its relatively small, acuminate leaves, few-flowered inflorescences, and its relatively small, purplish flowers borne on short pedicels.

Gibsoniothamnus parvifolius Barringer, sp. nov. TYPE: Panama. Chiriquí: NE del campamento Fortuna, 1000–1200 m, 15 Aug. 1976, *M. Correa, R. Dressler & Garibaldi 2500* (holotype, MO; isotypes, NY, PMA). Figure 1.

A *Gibsoniothamno epiphytico* foliis minoribus anguste lanceolatis vel ovato-lanceolatis acuminatis coriaceis, floribus solitariis vel geminatis differt.

Epiphytic shrub or small epiphytic tree to 4 m tall; young branches glabrous to sparsely pubescent, terete to slightly angled; older stems with gray-brown bark and persistent raised petiole bases. Leaves opposite, anisophyllous; larger leaves with petioles 3–7 mm long, the lamina narrowly lanceolate to obovate-lanceolate, 3–5.5 cm long, 1.0–1.8 cm wide, coriaceous, glabrous or rarely pubescent, gland-dotted, the base cuneate, the apex acuminate to long-acuminate, the veins immersed above, prominent and often reddish below, 2 or 3 secondary veins per side, the upper surface dark green, shiny, the lower surface light green, dull, domatia present in the axils of the secondary veins; smaller leaves with petioles 2–5 mm long, the lamina ovate-lanceolate, 1.6–2.2 cm long, 0.6–1.4 cm wide, coriaceous, glabrous or rarely pubescent, gland-dotted, the base rounded to acute, the apex rounded to obtuse, rarely acuminate, the veins impressed above, prominent and sometimes reddish below, 1–2 secondary veins per side. Flowers axillary, solitary or in pairs; pedicels 1.5–2.0 cm long, sparsely pubescent with glandular trichomes, slightly thickened above, bracteolate at base, the bracteoles linear, to 1 mm long; calyx campanulate, purple to red-purple, the tube 3–4 mm long, with 5 lobe-like enations that develop from the side of the calyx tube, the enations 8–9 mm long, 1 mm wide, narrowly triangular, slightly winged, glabrous, spreading; corolla cylindric, reddish violet to purple or lilac, 1.5–2.0 cm long, 3 mm diam., the upper lobes broadly ovate, 1.5–2.0 mm long, 2.0–2.5 mm wide, the lateral lobes ovate, 1.5–2.0 mm long, 1.5–2.0 mm wide, the median lobe ovate, 1.5–2.0 mm long, 2.0–2.5 mm wide, the lobes generally more darkly colored than the tube; stamens 4, attached about 5 mm above the base of the corolla tube, with a ring of trichomes at the level of attachment, the filaments 12–16 mm long, filiform, curved above, slightly thickened at the base; staminode 1.7–5.0 mm long; pistil glabrous, ovary globose, 1 mm tall, glandular at the base, the style elongate, 15–18 mm long, the stigma clavate to capitate. Berry globose, to 1 cm diam., green turning white, with 5–10(–20) seeds, the seeds fusiform, 2.0–2.5 mm long 1.0–1.4 mm wide, with a loose, hyaline, reticulate seedcoat.

This species is distinguished by its small leaves, slightly winged calyx with narrowly triangular enations, and few-flowered inflorescence. It is found growing on the volcanic mountains of Costa Rica and western Panama in two disjunct populations. The northern Costa Rican plants grow between 300 and 700 m, while the southern Costa Rican and Panamanian plants grow between 1000 and 1300 m elevation. The two populations differ slightly and may eventually prove to be distinct species. The northern plants tend to have terete, not angled, branches and smaller staminodes, less than 3 mm long. The distribution of the northern populations overlaps slightly with that of *Gibsoniothamnus epiphyticus* (Standley) L. O. Williams, native to central Costa Rica, and the southern populations.

This species is sometimes confused with *Gibsoniothamnus epiphyticus*, but the new species differs by its smaller, narrowly lanceolate, acuminate, coriaceous leaves, and 1- or 2-flowered inflorescence. In contrast, *G. epiphyticus* has elliptic, subcoriaceous leaves, 5.5–7.5 cm long, and flowers in condensed, paniculate inflorescences. The new species is also confused with *G. alatus* A. Gentry, but that species has large calyx wings, usually extending more than 4 mm, leaves 4–9 cm long, and white flowers. Many of the specimens of *G. parvifolius* are

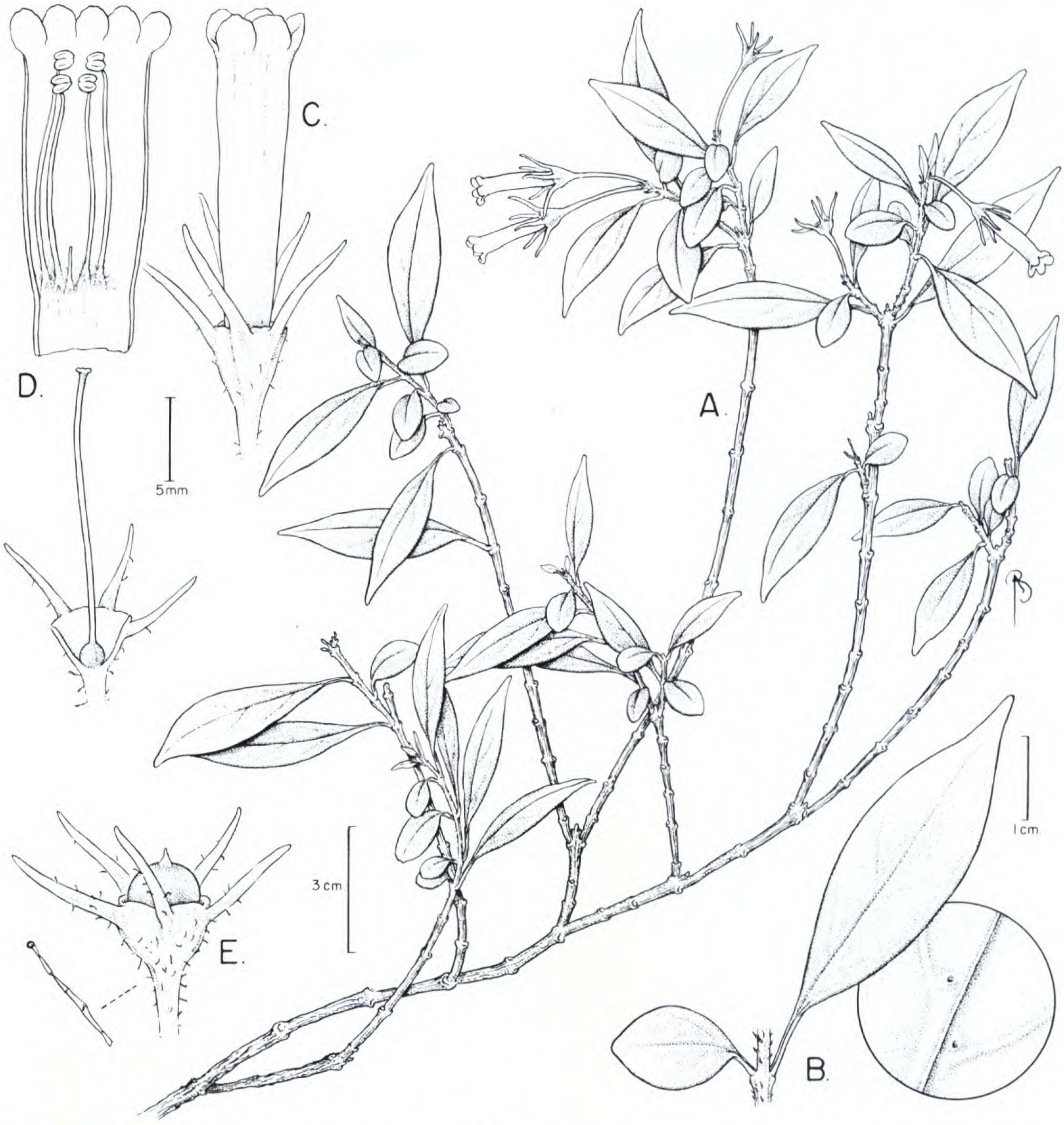

Figure 1. *Gibsoniothamnus parvifolius* Barringer. —A. Plant habit. —B. Unequal leaves at a node. —C. Flower habit. —D. Flower dissected; note the staminode and the enations on the calyx. —E. Fruit with detail of trichome.

tentatively identified as *G. pterocalyx* A. Gentry. That species has leaves that are acute and not as thick as those in *G. parvifolius*, the larger leaves at a node have petioles 1.0–1.3 cm long, the calyces are green, and the flowers are usually borne in condensed panicles.

D'Arcy (1979) included three specimens of this species under *G. alatus*, noting that they probably represented a distinct species.

Paratypes. Costa Rica. **Alajuela:** along road between Cañas and Upala, 8 km N of Bijagua, 300 m, 26 June 1976, *Croat 36505* (MO); Reserva Biológica Monteverde, Valle del Río Peñas Blancas 10°20′N, 84°43′W, 900 m, 28 Apr. 1987, *Haber & Cruz 7006* (CR, F, MO); Upala, Dos Ríos, 5 km al sur de Brasilia, margen derecha de Río Pizote, 10°55′N, 85°20′W, 500 m, 30 Oct. 1987, *Herrera 1015* (CR, F, MO); Upala, Colonia Libertad, 2 km NE, cuenca del Río Cucaracho, 450 m, 6 May 1988, *Herrera 1980* (CR, F, MO); Upala, Bijagua, El Pilón, 10°43′30″N, 85°00′30″W, 600 m, 12 July 1988, *Herrera 2071* (MO); Upala, Bijagua, El Pilón, camino a Chimurria 10°43′45″N, 84°59′58″W, 500–600 m, 20 July 1988, *Herrera 2131* (CR, F, MO); approx. 8 km N of Río Naranjo on the Cañas–Upala road, 2 km N of Bijagua, 400–500 m, 21 Sep. 1975, *Utley & Utley 3161* (DUKE, F, MO). **Guanacaste:** 6 km N of village of Río Chiquito, slope above Lake Arenal, 600–700 m, 10°25′N, 84°46′W, 8 May 1986, *Haber ex Bello et al. 4831* (MO); 6 km NE of Río Chiquito village, next to Lake Arenal, 10°27′N, 84°48′W,

600 m, 8 May 1988, *Haber ex Bello et al. 4789* (MO); Parque Rincón de la Vieja, Hacienda Santa María, 10°48′N, 85°19′W, 800–850 m, *Herrera 672* (MO); beside creek in pasture 3 km N of Río Naranjo, W of Tenorio Volcano, 550 m, 3 June 1972, *Lent 2559* (F); Los Ayotes, near Tilerán, 600–700 m, 21 Jan. 1926, *Standley & Valerio 45610* (US). PANAMA. **Bocas del Toro:** between Quebrada Higueron and Gutierrez, 18 Apr. 1968, *Kirkbride & Duke 754* (MO, NY); Fortuna Dam region, 8°45′N, 82°15′W, 1000 m, 8 Dec. 1985, *McPherson 7869* (MO, NY). **Chiriquí:** vicinity of Gualaca, 8.6 mi. from Planes de Hornito, La Fortuna, 4000 ft., 9 July 1980, *Antonio 5015* (MO); NE del Campamento Fortuna, Finca Pittí, 1000–1200 m, 16 Aug. 1976, *Correa et al. 2525* (F, NY); NO del campamento Fortuna, 8°45′N, 82°15′W, 1000–1200 m, 23 Sep. 1976, *Correa et al. 2571* (MO, NY, PMA); along road between Gualaca and Fortuna Dam site, 10.1 mi. NW of Los Planes de Hornito, 1300 m, 82°17′W, 8°45′N, 8 Apr. 1980, *Croat 49815* (MO); 9 mi. from Río Chiriquí Viejo bridge near Nueva California on road to Río Sereno, 7 Apr. 1979, *Hammel et al. 6833* (MO); road over Fortuna Dam, N of lake, 8°45′N, 82°15′W, 1110–1150 m, 27 Oct. 1985, *McPherson 7400* (MO); Fortuna, Potero de Pittier, 22 Feb. 1976, *Mendoza 794* (F); Fortuna Dam area, slope NW of confluence of Río Hornito and Río Chiriquí, 8°44′N, 82°13′W, 1050–1100 m, 11 Nov. 1980, *Sytsma & Stevens 2267* (MO).

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New Taxa of *Fuchsia* (Onagraceae) from Northern and Central Peru

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ABSTRACT. Two new taxa of *Fuchsia* from northern and central Peru are described and illustrated: *Fuchsia rivularis* subsp. *pubescens* P. E. Berry & Hermsen, a member of the large section *Fuchsia* from Cajamarca, and *Fuchsia mezae* P. E. Berry & Hermsen, a member of the apetalous section *Hemsleyella* from Huánuco.

Section *Fuchsia* is the largest of the 11 sections of *Fuchsia*, with 65 species. In the latest revision (Berry, 1982), several species were treated rather inclusively, acknowledging aberrant populations, but with too few specimens or too little information to place them in a different taxon. One of these was *F. rivularis* J. F. Macbride, known primarily from Amazonas in northern Peru, but with disjunct populations occurring across the dry Marañon River valley to the west in Cajamarca. Now that additional collections have been received from botanists from Cajamarca, we feel justified in describing the western populations as a new subspecies of *F. rivularis*. We also describe a distinctive new species of the apetalous section *Hemsleyella* from central Peru.

Fuchsia rivularis subsp. **pubescens** P. E. Berry & Hermsen, subsp. nov. TYPE: Peru. Cajamarca: trail from Chorro Blanco to San Andrés, Cutervo National Park, cloud forest, 2100–2200 m, 6°10′S, 78°45′W, 15 Sep. 1991, *A. Gentry et al. 74844* (holotype, MO). Figure 1.

Haec subspecies *Fuchsiae rivulari* subsp. *rivulari* similis sed ab ea foliis pubescentioribus minoribus apice emarginato acutove atque tubo florali angustiore distinguitur.

Scandent shrub or liana to 10 m above ground, with long, flexuous-arcuate, mostly unbranched shoots to several meters long. Young growth densely puberulent, the branchlets with erect trichomes ca. 0.25 mm long, older branches with exfoliating brown to red-brown bark. Leaves in whorls of 3 or 4, blades elliptic to obelliptic, 3–6 × 1–3 cm, apices variable from rounded and mucronate to obtuse or acute, bases acute to obtuse; upper leaf surface green and sparsely pubescent, the lower surface paler and densely pubescent in young leaves, with erect trichomes ca. 0.25 mm long, older leaves with trichomes persistent along the midvein and secondary veins of both surfaces, margins subentire to glandular-denticulate, secondary veins 13 to 15 on either side of the midvein, the midrib elevated on lower surface; petioles stout, pubescent, 2–4 mm long; stipules narrowly lanceolate, 1.5–2 mm long. Flowers to 4 per node, pendent in the uppermost leaf axils; pedicels drooping, pubescent, 12–18 mm long, 1–2 mm thick; floral tube narrowly funnelform, 47–58 mm long, 3–5 mm diam. at the slightly bulbous base, narrowing to 2–4 mm wide above, then widening again to ca. 8 mm wide at the rim, pubescent outside, more sparsely pubescent inside; sepal lobes 4, spreading at anthesis, narrowly lanceolate, 16–17 mm long, ca. 4 mm wide at the base, the distalmost 2–3 mm free in bud, densely pubescent outside, glabrous inside; petals 4, glabrous, narrowly elliptic, 16–18 mm long, 4–5 mm wide at the midpoint. Stamens 8, the antesepalous ones 12–13 mm long, the antepetalous ones 8–9 mm long; anthers ca. 4 × 1.5 mm. Ovary cylindrical, ca. 7 × 2 mm; style sparsely pubescent and protruding from the floral tube; stigma capitate, slightly 4-lobed at the apex, 2–2.5 mm long, ca. 1.5 mm wide. Unripe berries oblong, 8–12 mm long, 3–6 mm thick, densely pubescent.

Ecology and distribution. Only known to occur in cloud forest between 2000 and 2500 m elevation in Cajamarca in northern Peru.

This new subspecies differs from subspecies *rivularis* by having short, dense indumentum on the leaves and young stems, which is much less evident in subspecies *rivularis*. *Fuchsia rivularis* subsp. *pubescens* also has more slender flowers than subspecies *rivularis*, a more pilose style, and smaller, emarginate to acute leaves. *Fuchsia rivularis* subsp. *pubescens* is geographically separated from populations of subspecies *rivularis* by the dry, low Marañon River valley, a well-known biogeographic barrier to mesic montane taxa in northern Peru.

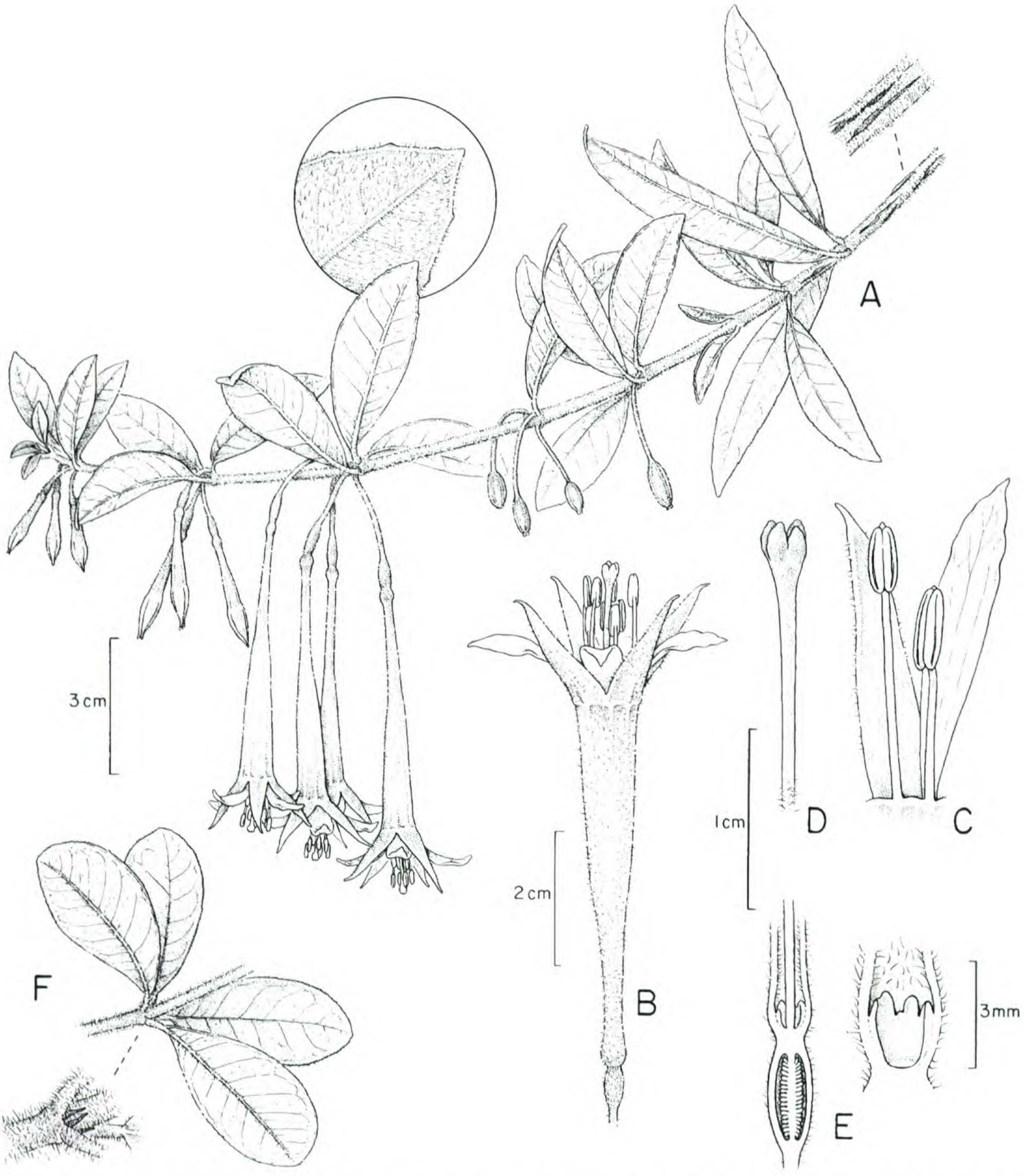

Figure 1. *Fuchsia rivularis* subsp. *pubescens* P. E. Berry & Hermsen. —A. Habit, with details of leaf and stem pubescence. —B. Flower at anthesis (inverted). —C. Detail of sepal, petal, and stamens from each of the two staminal whorls. —D. Upper part of style showing slightly 4-lobed stigma. —E. Longitudinal section through the ovary and lower section of the floral tube, with enlarged detail showing the nectariferous region at the base of the tube. —F. A typical whorl of leaves, with detail of pubescence and stipules. A–E drawn from *Gentry et al. 74844*, F drawn from *Sánchez 304*.

Paratypes. PERU. **Cajamarca:** Jaen Province, Colasay District, Agua Fria 2 hrs. walk N and up from Colasay, 2000 m, 6°S, 79°10′W, 7 July 1993, *Milanowski & Shonle 165* (MO); Prov. Cutervo, Distr. de San Andrés, Las Grutas, 2350 m, 13 Oct. 1987, *Sánchez 304* (MO); Prov. Cutervo, La Pucarilla, between Socata and San Andrés, *Sánchez et al. 5926* (MO); Socata–San Andrés, *López & Sagástegui 5372* (MO); Achira, near Socota, Prov. Cutervo, *Velarde 7065* (Z); El Suro, Prov. Cutervo, *Velarde 7022* (Z).

Fuchsia mezae P. E. Berry & Hermsen, sp. nov. TYPE: Peru. Huánuco: Quebrada antes de Utao, 2430 m, 4 Oct. 1965, *I. Meza 360* (holotype, MO). Figure 2.

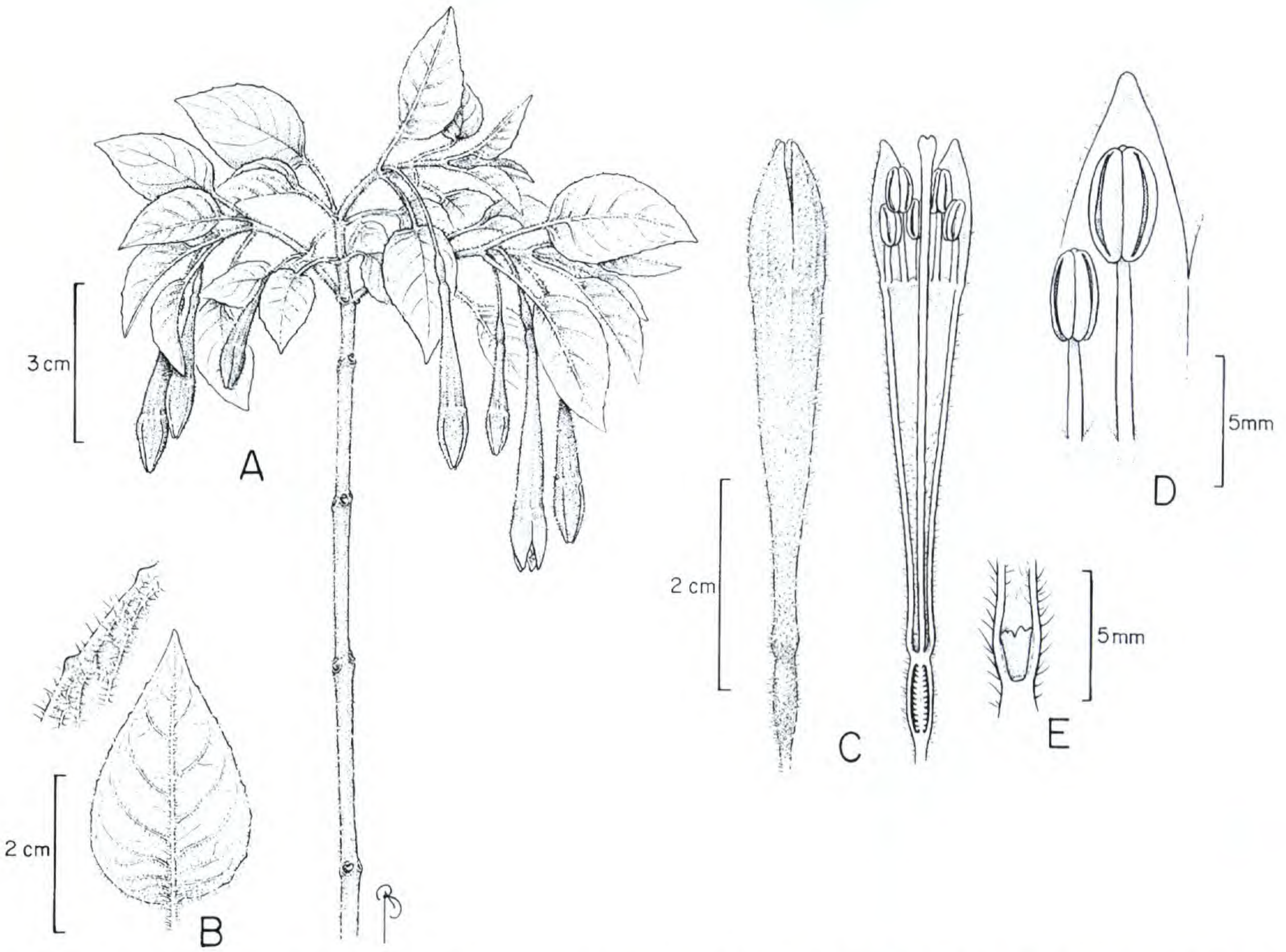

Figure 2. *Fuchsia mezae* P. E. Berry & Hermsen. —A. Habit. —B. Young leaf blade and detail of margin. —C. Intact flower (left) and longitudinal section (right) in advanced bud stage before anthesis. —D. Detail of sepal, and stamens from each of the two staminal whorls (note absence of petals). —E. Detail of nectariferous band at the base of the inside of the floral tube. Drawn from *Meza 360*.

Frutex ca. 0.5 m altus, ramulis erectis. Folia opposita vel ternata, juniora ovata pubescentia, 2–4 × 1.5–2.0 cm, petiolis junioribus 7–14 mm longis. Inflorescentia ex floribus axillaribus solitariis constans, pedicellis 15–20 mm longis. Flores nondum maturi, apetali, tubo florali usque ad 40 mm longo, sepalis ante anthesin 10–13 mm longis.

Shrub ca. 0.5 m tall, stems erect and mostly bare of leaves, to 5 mm diam., lower internodes 5–6 cm long, leaf scars opposite or ternate; new flush of leaves and flowers subterminal on short side branches 1.5–4 cm long. Leaves mostly opposite, young expanding blades densely pubescent with ± erect whitish trichomes 0.5–0.7 mm long, blades ovate, 2–4 × 1.5–2 cm, with 7 to 9 secondary veins per side, densely pubescent on lower side, sparsely pubescent on upper surface, margins glandular-denticulate; petioles 7–14 mm long; stipules brown, triangular, 1 × 1 mm. Flowers axillary, preanthesal, pedicels 15–20 mm long, the largest flower with floral tube 40 mm long, 2–2.5 mm wide at the base, gradually tapered to ca. 5 mm wide at the base of the sepals, pink and pubescent outside, inside with a nectariferous band lining the basal 3 mm of the tube; sepals 10–13 mm long, basally connate in the lower 1/2 to 1/3, green in the distal half and broader than the floral tube, sepals broadly acute at the apex, ca. 4 mm wide at their widest; petals 0. Stamens 8, the antesepalous filaments ca. 10 mm long, the alternating series ca. 6 mm long; anthers oblong, 3 mm long, 1.5 mm wide. Ovary narrowly cylindrical, 8–9 mm long, style pubescent in lower 1/3, stigma clavate, 2 mm long, 1.5 mm wide. Fruit not seen.

Ecology and distribution. Only known from the type specimen, found growing along a streamside at 2430 m in Huánuco, Peru, beginning to leaf and flower in early October.

Although *Fuchsia mezae* is known from a single specimen without fully expanded leaves or flowers, it is clearly a new species belonging to section *Hemsleyella*, which has 14 other recognized species (Berry, 1985). This section is an unusual group of species restricted to the tropical Andes and is characterized by its apetalous flowers, strongly seasonal flowering (usually during the dry season), common

presence of tubers, and smooth floral nectaries lining the base of the floral tubes. Most of the species in this section have alternate leaves, but three other Peruvian species in the section have opposite leaves, namely *F. cestroides* Schulze-Menz, *F. huanucoensis* P. E. Berry, and *F. tunariensis* Kuntze. *Fuchsia cestroides* has much smaller flowers and leaves, and *F. huanucoensis* is glabrous, with funnelform floral tubes, lanceolate sepals, and narrowly elliptic-ovate leaves. *Fuchsia mezae* is most similar to *F. tunariensis* but differs from it in its longer, stiffer indument, narrower floral tubes and sepals, and more erect habit. Section *Hemsleyella* is characterized by the great rarity of many of its species, some of them known from just one or a few collections. For this reason we feel justified in describing this species, albeit without a full range of flowering and fruiting specimens, because it is clearly distinct from other members of the genus, and it calls attention to the high degree of local endemism in the mountains of central Peru.

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Contributions Toward a Revision of *Begonia* Section *Weilbachia* (Begoniaceae)

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ABSTRACT. Characteristics of *Begonia* sect. *Weilbachia* (Klotzsch & Oersted) A. DC. (Begoniaceae) are discussed, and four new species in the section, *B. almedana*, *B. hondurensis*, *B. faustinoi*, and *B. turrialbae*, are described, illustrated, and compared with other species in the section.

The genus *Weilbachia* was described by Klotzsch and Oersted (1855) for those species in *Begonia* with four staminate and three pistillate perianth segments and bilocular ovaries with two parted styles. Although Klotzsch and Oersted did not include capsular orientation in their generic description, both species placed in the genus, *W. reptans* Klotzsch & Oersted and *W. pustulata* (Liebmann) Klotzsch & Oersted, were characterized as having nutant capsules. Alphonse De Candolle (1859) reduced *Weilbachia* to a section within *Begonia*. Its description was emended subsequently to include species with apetalous staminate perianths, pistillate flowers with two "lobes," and nutant capsules (De Candolle, 1864). Individuals of many species within the section have pistillate flowers with two or three styles (Burt-Utley, 1985), including *B. pustulata*, which De Candolle (1864) characterized as having two styles. When three styles are present, a stigma borne on one of the styles sometimes appears smaller and less well developed than the other two. Section *Liebmannia* Ziesenhenne was described for a species with apetalous pistillate flowers, three styles, and bilocular ovaries (Ziesenhenne, 1976). Although Ziesenhenne (1976) discussed the cane-like habit of the type species, he chose not to include this character in his Latin diagnosis and relied on floral characters exclusively. Because style number is variable within a species and section *Liebmannia* cannot be distinguished from section *Weilbachia* using other floral or vegetative characters (Burt-Utley, 1985), section *Liebmannia* is herein considered synonymous with section *Weilbachia*. A similar conclusion was recently published by Doorenbos et al. (1998) relying solely on plant habit.

Begonia sect. *Weilbachia* is the only neotropical section having species with characteristically bilocular ovaries. With the exception of sections *Gobenia* A. DC. and *Tetrachia* Brade, which have quadrilocular ovaries, species in all other neotropical sections have trilocular ovaries. Capsules of species in section *Weilbachia* are also unusual among neotropical Begoniaceae in having a succulent or fleshy outer layer that must erode before the capsules can dehisce (pers. obs.). In other neotropical sections, as capsules mature they begin drying without first shedding an outer layer of tissue and then dehisce near the base of the locules or rarely through the wings. Section *Weilbachia* includes about 25 species that are distributed from the states of Veracruz, Puebla, and Jalisco in Mexico to northwestern Panama. Of these, almost half are endemic to Mexico. As a result of our continued research with neotropical *Begonia*, a planned revision of section *Weilbachia*, and treatment of the family for *Flora Mesoamericana*, four species are herein proposed as new within section *Weilbachia*.

Begonia sect. **Weilbachia** (Klotzsch & Oersted) A. DC., Ann. Sci. Nat. IV. 11: 134. 1859. *Weilbachia* Klotzsch & Oersted, Abh. Königl. Akad. Wiss. Berlin. 1854: 239. 1855.

Begonia sect. *Liebmannia* Ziesenhenne, The Begonian 43: 64. 1976.

Begonia hondurensis Burt-Utley & Utley, sp. nov. TYPE: Honduras. Atlántida: along Danto River, slopes of Mt. Cangrejal, 1200 ft., 2 Aug. 1938, *T. G. Yuncker, J. M. Koepper & K. A. Wagner 8773* (holotype, F; isotypes, BM, GH, MICH, MO, NY, US). Figure 1.

Rhizomata repentia; internodia squamosa. Petioli indumentis (1–)2–4 mm longis dense squamosi. Florum ♂ petala 4.5–8 × 1.4–3.5(–5) mm; stamina 22–49. Ovaria bilocularia.

Herbaceous perennials; rhizomes repent, internodes usually elongate and slender, rarely short, 0.5–6.6 cm long × 1–3(–4) mm diam., glandular-squamose with laciniate scales to 3 mm long; stipules persistent, narrowly ovate-triangular, 0.8–1.7 cm × 4.5–9 mm, glandular-pilose, strongly keeled, with the keel laciniate; petioles 6.5–23 cm long,

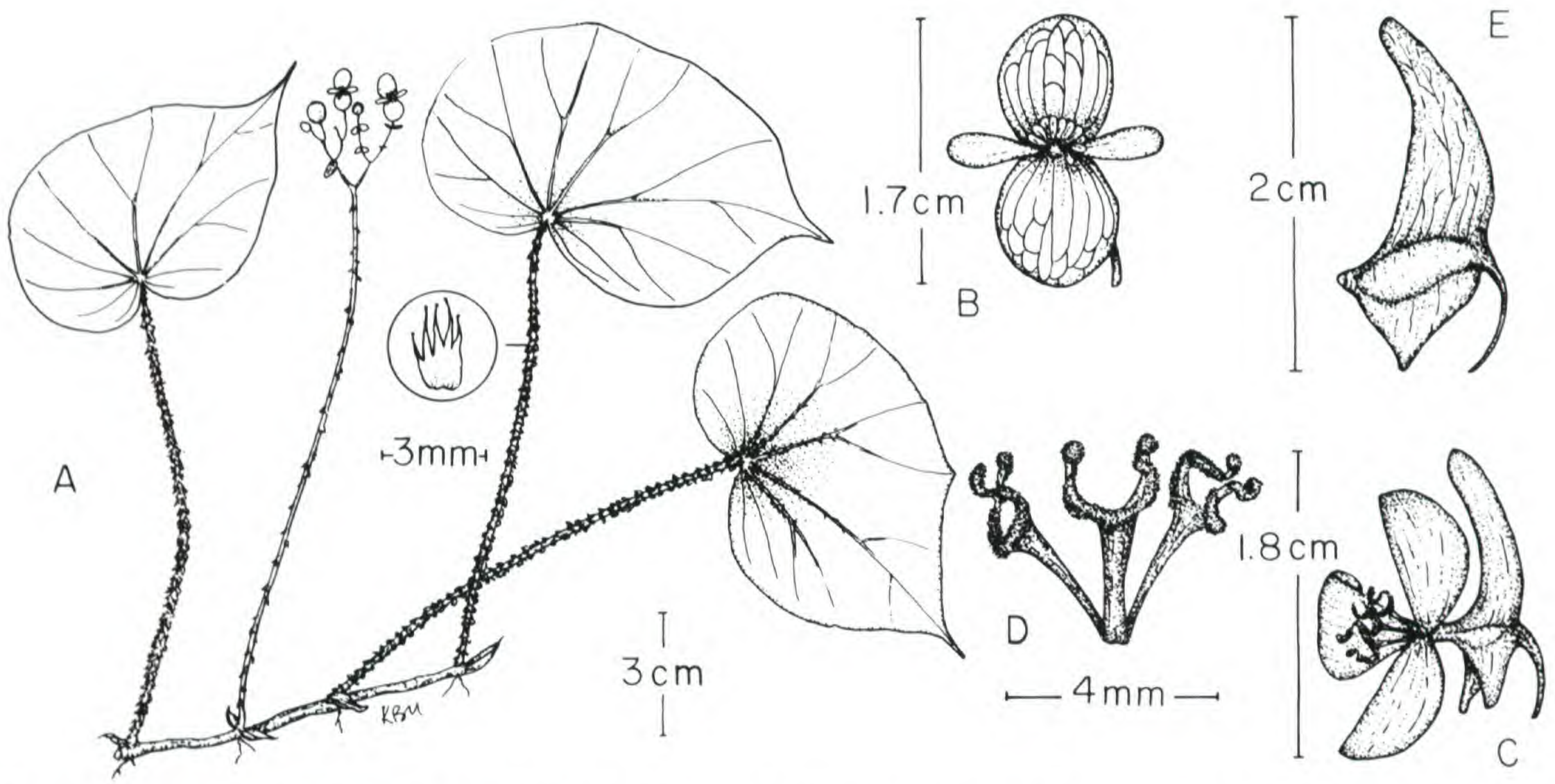

Figure 1. *Begonia hondurensis* Burt-Utley & Utley. —A. Habit with insert showing petiole scale. —B. Staminate flower. —C. Pistillate flower. —D. Stigmas. —E. Capsule. (A, B, E from *Yuncker et al. 8773*; C, D from *Evans 1562*.)

densely glandular-squamose with broad laciniate scales (1–)2–4 mm long, often appearing glandular-tipped; leaf blades oblique to transverse, asymmetrically ovate to obovate or reniform-elliptic, 6.8–13.8(–14.6) × 4.5–7(–9) cm, basally cordate, apically acute to attenuate-acuminate, marginally sparingly ciliate and irregularly dentate to crenate at the end of major nerves, green throughout to red-maculate at vein junctions and glandular to glabrous above except for villi at the petiole-blade junction, glandular-hirtellous beneath with trichomes most dense on principal nerves, 8–10-palmatinerved; inflorescences shorter than to exceeding the foliage, symmetric to weakly asymmetric, laxly cymose, few-flowered; peduncles 10.5–25 cm long, sparingly glandular-villous becoming glabrate with age; bracts deciduous, the lowermost ovate to narrowly elliptic, 5–8 × 2–5 mm, marginally entire, externally sparingly glandular, weakly keeled; staminate flowers: pedicels 4.5–10 mm long; sepals 2, membranaceous, suborbicular to broadly transversely elliptic, 6–10 × 6.5–10 mm, sparingly glandular and white to pink externally; petals 2, oblanceolate, 4.5–8 × 1.4–3.5(–5) mm; stamens 22–49; filaments 0.2–1.3 mm long, borne on a raised torus; anthers oblong to narrowly obovate, 1–1.5 × 0.4–0.9 mm; pistillate flowers: pedicels 5.5–7.5 mm long; bracteoles wanting; sepals 2, suborbicular to oblong-elliptic, 8.5–11 × 10–11 mm, sparingly glandular and white to light pink; petal only 1, obovate, 10 × 4–7 mm; ovary bilocular with bipartite placentae, 5–8 mm long, sparingly glandular to glandular-villous; styles 3 or rarely 4, 1.5–2.5 mm long, connate only briefly basally; stigmas broadly lunate with ends beginning to spiral to bicornute; capsules with pedicels 8–11 mm long, strongly nutant, frequently somewhat beaked, thick and fleshy, drying coriaceous, (9–)10.5–12 mm long; wings 3, unequal, the largest falcate to subfalcate, 14–17 × 5–8 mm, the others subequal, triangular, 3–7 × 8–10 mm.

Distribution. Known only from near La Ceiba in the Department of Atlántida, Honduras, where it has been collected between 140 and 365 m on slopes along rivers and streams.

Begonia hondurensis is distinguished from all other species in section *Weilbachia* by a combination of characters including squamose internodes and petioles, coupled with staminate and pistillate flowers with petals. A squamose indumentum has been observed on only one other species in the section, *B. vestita* C. DC. from southern Central America. Although *B. vestita* clearly has bilocular ovaries and capsules consistent with its inclusion in section *Weilbachia*, it was listed in section *Gireoudia* (Klotzsch) A. DC. (Barkley & Golding, 1974; Doorenbos et al., 1998) possibly because Casmir De Candolle (1908) mistakenly characterized the capsules as trilocular. *Begonia hondurensis* differs from *B. vestita* in its petalous staminate and pistillate flowers, as well as its capsules with narrow falcate to subfalcate primary capsule wings (14–17 mm high, 5–8 mm wide). In contrast, primary wings of *B. vestita* are asymmetrically oblong and (5–)8–12 mm high and (4–)8–13 mm wide.

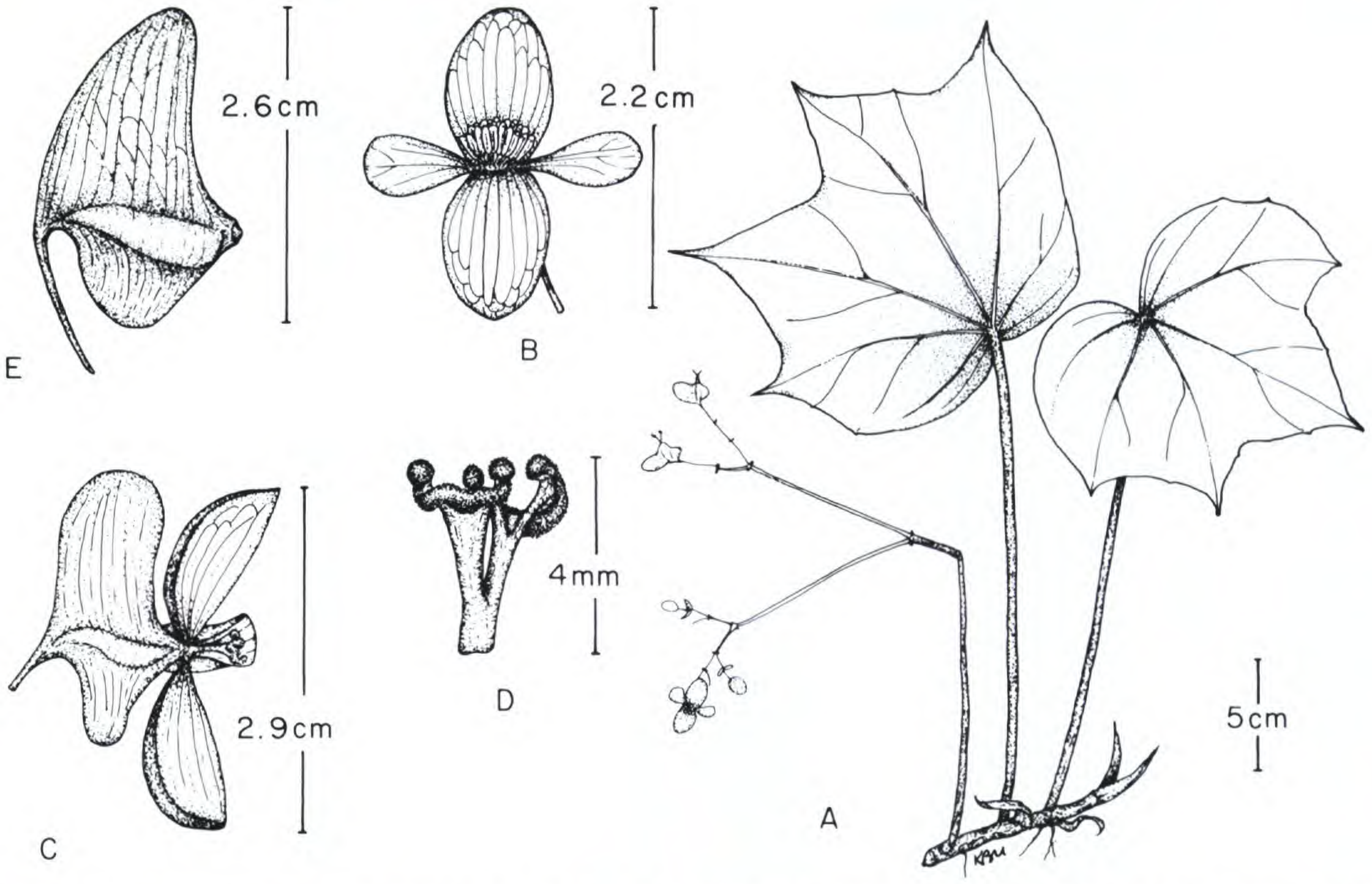

Figure 2. *Begonia almedana* Burt-Utley & Utley. —A. Habit. —B. Staminate flower. —C. Pistillate flower. —D. Stigmas. —E. Capsule prior to dehiscence. (From *Utley & Utley 8425.*)

Paratypes. HONDURAS. **Atlántida:** Cordillera Nombre de Dios, Quebrada Grande on lower N slope of Pico Bonito, *Blackmore & Chorley 4178* (BM); base of N slope of Pico Bonito, E of new CURLA camp building on Quebrada Grande, ca. ⅓ km above its confluence with Río Bonito, 10 km SW of La Ceiba, Parque Nacional Pico Blanco, 140 m, *Evans 1562* (MO, NOLS); Campamento Quebrada Grande ca. 10 km SW of La Ceiba, at base of N slope of Pico Bonito, 140 m, *Liesner & Mejia 26016* (EAP, MO, NOLS, TEHF), *Liesner & Mejia 26035* (MO); Montaña La Manga, 30 km SE de La Ceiba, *Nelson, Vargas & Alduvin 3299* (TEHF); Ceiba, *Dyer A211* (US).

Begonia almedana Burt-Utley & Utley, sp. nov. TYPE: Mexico. Chiapas: cloud forest along banks of Río Jol Uk'um, about 43.5 mi. S of Palenque near 100 km marker and 7.8 mi. S of turnoff to Cascadas Agua Azul on MEX 199 to Ocosingo, 1900 ft., 21 July 1989, *J. Utley & K. Utley 8425* (holotype, MEXU; isotypes, B, BM, C, CAS, DUKE, F, MICH, MO, US). Figure 2.

Rhizomata repentia; internodia hirtella. Petioli hirtelli; laminae 3–4-lobatae. Florum ♂ sepala 7.5–11.5(–13) × 5.5–9.5 mm; petala 8–10.5 × 4.5–7(–8) mm; stamina 30–76. Ovaria bilocularia glandulosa hirtella styli duo.

Herbaceous perennials; rhizomes repent, elongate, generally branching, internodes short to elongate, 0.3–1.6(–4.1) cm long × 3–5(–8) mm diam., sparingly glandular-hirtellous with trichomes 0.2–0.4 mm long; stipules caducous to deciduous, fleshy but becoming chartaceous upon drying, narrowly ovate-triangular, (0.9–)1.3–3.1 cm × 4.5–8.5 mm, marginally entire, glandular to very sparingly glandular-hirtellous, strongly keeled with the keel fimbriate and occasionally laciniate; petioles 10.6–24.8 cm long, glandular-hirtellous with short spreading to ascending villi 0.3–0.8 mm long often appearing glandular-tipped; leaf blades oblique or rarely straight, asymmetric, suborbicular to broadly obovate, transversely elliptic or rarely ovate, 9.3–19.8 × 7.7–17 cm, basally very shallowly cordate to occasionally deeply cordate, apically attenuate-acuminate, rarely appearing bilobed with no distinct apex, marginally serrulate-denticulate and asymmetrically palmately lobed, usually with 3–4 major attenuate-acuminate lobes to ⅓ the blade length, dark green and sparingly glandular to glandular-hirtellous above, pale green and sparingly glandular-hirtellous beneath with trichomes most dense on principal nerves, (6–)8–9(–11)-palmatinerved; inflorescences much shorter than to exceeding the foliage, weakly to strongly asymmetric, laxly cymose, few- to many-flowered; peduncles often unusually short, (3–)9.1–23(–31) cm long, glandular and very sparingly hirtellous; bracts caducous to deciduous, the lowermost often smaller than secondary bracts, ovate to narrowly ovate, ovate-tri-

Table 1. Comparison of *B. almedana* with *B. ludicra*.

	B. almedana	*B. ludicra*
Stipule length (cm)	(0.9–)1.3–3.1	0.6–1.2
Petiolar pubescence (mm)	0.3–0.8	0.3–2
♂ sepal size (mm)	7.5–11.5(–13) × 5.5–9.5	(8–)12–22 × (7–)12.5–18
♂ petal size (mm)	8–10.5 × 4.5–7(–8)	11–16 × 3–4.5(–6)

angular or rarely transversely broadly ovate, to orbicular, 3–15.5 × 3.5–7.5 mm, apically attenuate-acuminate or infrequently rounded, marginally entire, sparingly glandular, occasionally keeled; staminate flowers: pedicels 8–14 mm long, glabrous to sparingly glandular, sepals 2, fleshy, elliptic to broadly elliptic, ovate-elliptic, obovate, or rarely suborbicular, 7.5–11.5(–13) × 5.5–9.5 mm, glabrous to sparingly glandular, pink externally; petals 2, broadly oblanceolate, 8–10.5 × 4.5–7(–8) mm, white, apically frequently obcordate, rarely rounded; stamens 30–76; filaments 0.3–1.3 mm; anthers narrowly oblong-elliptic to obovate, 1.6–3.3 × 0.4–0.5(–0.7) mm; pistillate flowers: pedicels 6–16 mm long, ebracteolate or often with 1 or 2 bracteoles to 3.5 mm long; sepals suborbicular to transversely broadly elliptic, 7–13 × 7.5–15 mm, dark pink; petal only 1, oblanceolate, 9.5–12.5 × 5–8 mm, white; ovary 5.5–10 mm long, glandular to glandular-hirtellous; styles 2, connate only briefly basally or rarely to over half their length; stigmas dilated-lunate to weakly bicornute; capsules with pedicels (0.9–)1.2–2.5 cm long, strongly nutant, bilocular with bipartite placentae, thick and fleshy but drying cartilaginous, (0.9–)1.1–1.7 cm long; locules 6.5–10(–11.5) mm long; wings 3, unequal, the largest often falcate, narrowly triangular, oblong or rarely broadly ovate, (0.8–)1.1–2.2 × 0.9–1.5 cm, the second and third subequal, triangular, (0.5–)0.7–1.2 × 0.8–1.1 cm.

Distribution. Known from limited collections from Chiapas, Mexico, in primary forests between 450 and 580 m elevation. It is common at the type locality on forested banks of the Río Jol Uk'um.

Begonia almedana is most similar in its conspicuously lobed leaf blades to a group of species within section *Weilbachia* that includes *B. purpusii*, *B. ludicra*, and *B. confusa*. It differs from the generally erect stems of *B. purpusii* in its repent habit and flowers with both sepals and petals. Although both *B. almedana* and *B. purpusii* occur in Chiapas, they are found in different physiographic regions recognized by Breedlove (1973); *B. almedana* is known only from the Gulf Coastal Plain at 450 to 580 m elevation, while *B. purpusii* occurs in the Sierra Madre de Chiapas between 1100 and 2400 m, and extends into Guatemala and northwestern El Salvador. *Begonia confusa* is only known from immature flowers on the type collection from Guatemala, but its densely villous sepals distinguish it from *B. almedana*. Distribution and a suite of characters (Table 1) effectively separate *B. almedana* from *B. ludicra*, which ranges from Puebla and Veracruz to the wet, northern slopes of the Sierra Madre in central Oaxaca.

Begonia almedana is named in honor of Frank Almeda who first collected this unusual species along with Dennis Breedlove.

Paratypes. MEXICO. **Chiapas:** Mpio. Ocosingo, 70 km SW of Palenque on rd. to Ocosingo along the Río Jol Uk'um, 550 m, *Breedlove 47468* (CAS), *Breedlove & Almeda 48274* (CAS), *Breedlove & Almeda 48291* (CAS), *Breedlove & Keller 49588* (CAS), *Breedlove 52539* (CAS); Mpio. Chontal, rd. between San Cristóbal de las Casas and Palenque, 136 km NE of San Cristóbal, Villa Paraíso, 17°29′N, 92°05′W, 450 m, *Hammel, Martínez & Merello 15645* (MO); banks of Río Jol Uk'um 43.5 mi. S of Palenque on MEX 199 to Ocosingo, 1900 ft., *Utley & Utley 8356* (MEXU).

Begonia faustinoi Burt-Utley & Utley, sp. nov. TYPE: Mexico. Chiapas: Mpio. Berriozábal, 13 km N of Berriozábal in vicinity of Pozo Turpache, 900 m, *J. Utley & K. Utley 8343* (holotype, MEXU; isotypes, B, C, CAS, DUKE, F, GH, MICH, MO, NY, US). Figure 3.

Rhizomata repentia; internodia villosa. Laminae ad marginem duplicato-dentatae vel duplicato-serratae; petioli trichomatibus 1.5–3(–4) mm longis villosi. Bracteae ad marginem ciliatae laciniatae. Stamina 31–63. Ovaria bilocularia villosa.

Herbaceous perennials; rhizomes repent, often branching; internodes slender, very short to elongate, 0.6–10.5 cm × 1.5–3(–4) mm, villous with trichomes 1–3 mm long; stipules persistent, very narrowly triangular to lanceolate, 8–17(–23) × 3–6(–8) mm, often strongly keeled, marginally entire, glabrous to villous throughout; petioles (2.8–)7.8–13(–21.5) cm long, villous with spreading trichomes 1.5–3(–4) mm long; leaf blades chartaceous, usually oblique, asymmetrically ovate, (5–)

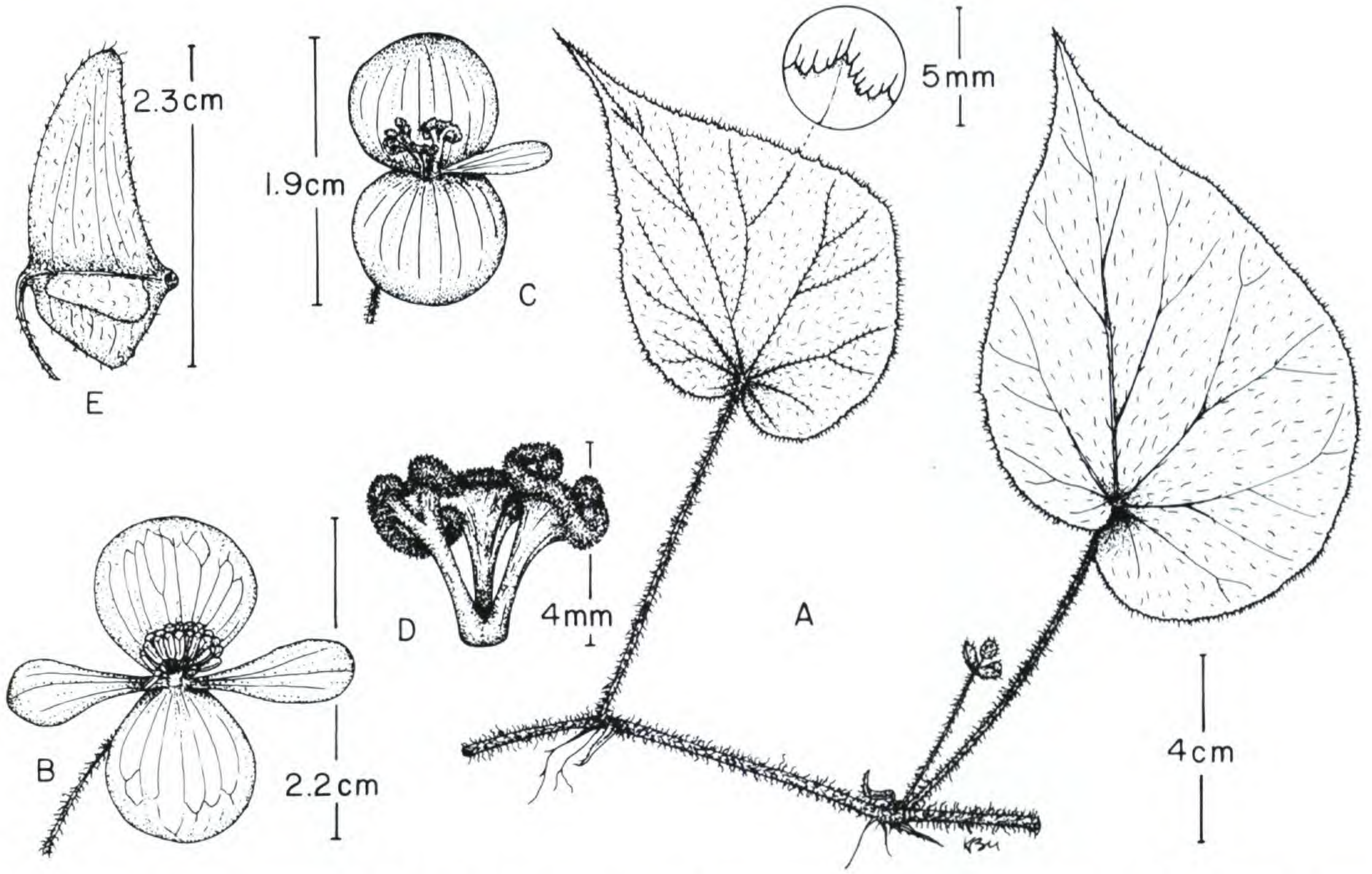

Figure 3. *Begonia faustinoi* Burt-Utley & Utley. —A. Habit with insert showing leaf margin. —B. Staminate flower. —C. Pistillate flower. —D. Stigmas. —E. Capsule. (From *Utley & Utley 8343.*)

7.5–12.5(–16) × (3.5–)5–8(–10.6) cm, basally cordate, apically attenuate-acuminate, marginally ciliate-denticulate to ciliate-serrulate and doubly dentate to doubly serrulate, villous above and below with trichomes to 3 mm long, (8–)9–10(–11)-palmatinerved; inflorescences generally shorter than the foliage, cymose, few-flowered; peduncles (4–)6.2–13.5(–17.3) cm long, villous with trichomes 0.5–3.5(–5) mm long; bracts deciduous, the lowermost occasionally navicular, elliptic to ovate, 5–7(–9.5) × 3.5–6 mm, marginally ciliate-laciniate, villous; staminate flowers: pedicels (3.5–)7–22(–31) mm long; sepals 2, fleshy but chartaceous upon drying, suborbicular to elliptic, ovate or obovate, 5–14(–17) × (3–)5.5–14 mm, externally villous; petals 2, narrowly obovate to oblanceolate, 5–13(–17) × (1.5–)2.5–5(–6) mm; stamens (20–)31–63; filaments (0.4–)1–2 mm, inserted on a low torus; anthers narrowly oblong to obovate, 0.8–1.5(–1.8) × (0.3–)0.5–0.7 mm; pistillate flowers: pedicels 6–11.5(–14) mm long; bracteoles wanting or if present 1 or 2 and borne on the pedicel, 1–2.5 mm long; sepals 2, chartaceous, suborbicular to broadly obovate or transversely elliptic, 6–12.5(–15) × 4.5–13.5(–15) mm, externally villous; petal only 1 or wanting, oblanceolate, 7–10 × 2–4.5(–7) mm; ovary bilocular with bipartite placentae, 5.5–8.5(–10.5) mm long, villous; styles 3, 2–3 mm long, fused briefly basally; stigmas dilated-lunate or weakly bicornute, but 1 often smaller than the other 2; capsules with pedicels 10–26 mm long, 9–14 mm long; locules narrowly oblong-elliptic, 6.5–10 × 1.5–2.5 mm; wings 3, unequal, the largest asymmetrically ovate-triangular to oblong, 12–18 × 7–10.5 mm, marginally ciliate, the second and third subequal to each other, 3.5–5 × 8–12 mm.

Distribution and habitat. Known only from Chiapas, Mexico, between 600 and 900 m elevation, but should also occur in adjacent parts of Guatemala. *Begonia faustinoi* is locally abundant on karstic formations near Pozo Turpache.

Begonia faustinoi is most similar to *B. pustulata* Liebmann, which is not known to occur in Chiapas. These species share a similar villous indument, staminate and pistillate flowers with sepals and petals, as well as nutant, bilocular capsules. *Begonia faustinoi* can be distinguished from *B. pustulata* by its smooth upper leaf surfaces; those of *B. pustulata* are consistently pustulate or bullate. These two species are also distinguished from each other by additional leaf characters and peduncle length summarized in Table 2.

This species is named in honor of Faustino Miranda who contributed significantly to knowledge of the vegetation of Chiapas.

Table 2. Comparison of *B. faustinoi* with *B. pustulata*.

	B. faustinoi	*B. pustulata*
Blade length (cm)	(5–)7.5–12.5(–16)	(7.7–)12–23
Blade width at widest point (cm)	(3.5–)5–8(–10.6)	(4.6–)8–16.7
Blade margin	ciliate-denticulate to serrulate; doubly dentate to serrate	ciliate-denticulate
Number of nerves	(8–)9–10(–11)	(9–)11–14
Petiole length (cm)	(2.8–)7.8–13(–21.5)	(4.5–)12.5–33
Peduncle length (cm)	(4–)6.2–13.5(–17.3)	(8.5–)15–39

Paratypes. MEXICO. **Chiapas:** Mpio. Berriozábal, 13 km N of Berriozábal, 1000 m, *Breedlove & Smith 21659* (DS); 13 km N of Berriozábal near Pozo Turpache and Finca El Suspiro, 900 m, *Breedlove & Dressler 29711* (DS, MO), *Breedlove & Thorne 30856* (DS, MEXU, MICH, MO), *Utley & Utley 8747* (CAS, MEXU, MICH, MO, US); Mpio. Palenque, near Agua Azul, 600 m, *Breedlove & Almeda 57270* (CAS).

Begonia turrialbae Burt-Utley & Utley, sp. nov. TYPE: Costa Rica. Cartago: about 7.2 km E of Tuis and 5.3 km E of Platanillo along rd. to Bajo Pacuare and Moravia, 2900 ft., *J. Utley & K. Utley 7261* (holotype, MO; isotypes, CAS, CR, DUKE, F, US). Figure 4.

Rhizomata repentia; internodia villosa. Petioli villosi; laminae pustulatae. Inflorescentiae paucifloribus. Florum ♂: sepala 6.5–17 × 4.5–12 mm; petala 5.5–12.5 × 1–3.8 mm; stamina (19–)25–46. Florum ♀: sepala 4.5–8 × 4.5–9 mm; ovaria bilocularia; styli 3.

Herbaceous perennials; rhizomes repent, internodes short to elongate, 0.3–5.4 cm × 1–3.5 mm, villous with trichomes to 2.5 mm long; stipules persistent, lance-ovate to lanceolate, 3.5–6(–8.5) × 2.5–4(–5) mm, marginally entire, sparingly villous throughout to glabrous; petioles 3–7(–14.5) cm long, glandular and villous with spreading trichomes to 3 mm long; leaf blades simple, oblique, asymmetrically ovate to oblong, 3.5–9(–11) × 2.5–5(–7.8) cm, basally cordate with lobes often overlapping, apically acute to acuminate, marginally ciliate-denticulate, papillose and finely pustulate above with trichomes 0.5–2.5 mm long terminating

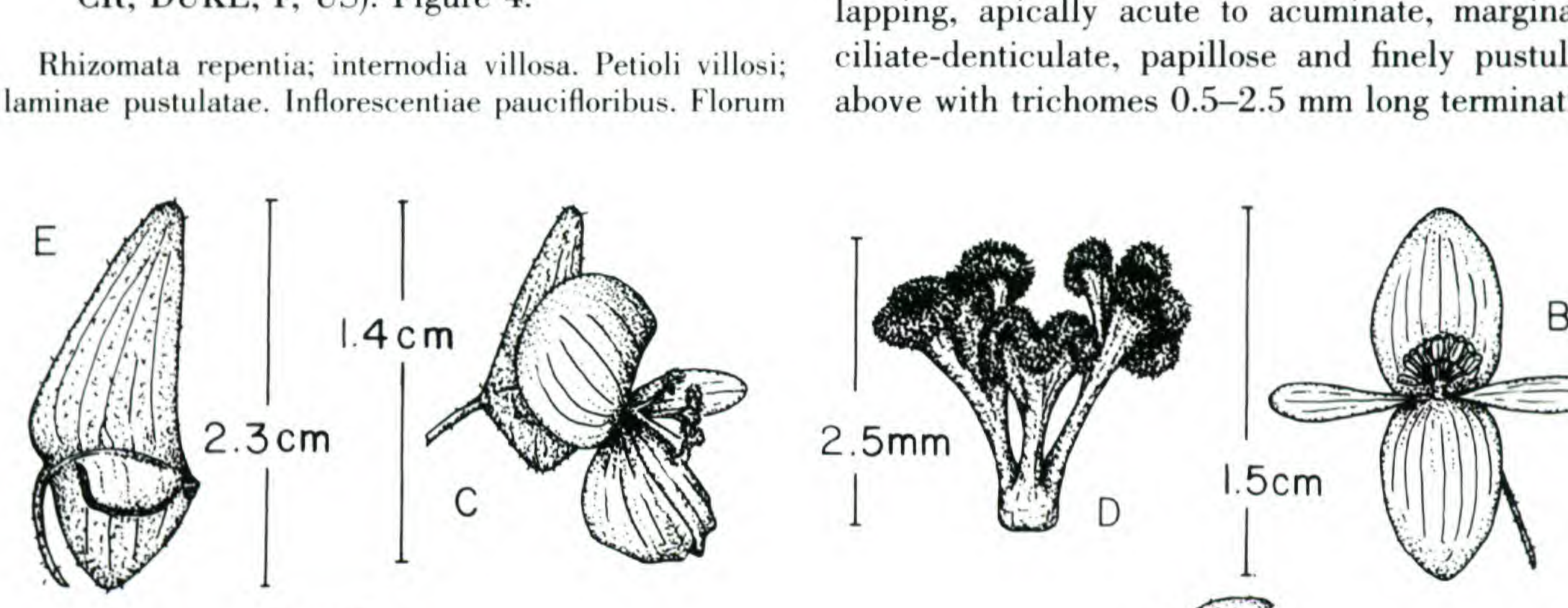

Figure 4. *Begonia turrialbae* Burt-Utley & Utley. —A. Habit. —B. Staminate flower. —C. Pistillate flower. —D. Stigmas. —E. Capsule. (From *Utley* & Utley *7261*.)

pustules, glandular and villous throughout below with trichomes to 1.3 mm long, (8–)10–11-palmatinerved; inflorescences cymose, very few-flowered; peduncles 2.3–9.7 cm long, glandular and sparingly to densely villous with trichomes to 1.5 mm long; bracts caducous to deciduous, the lowermost ovate to elliptic, 3–3.5(–6) × 0.5–1.5(–3) mm, glabrous, marginally entire; staminate flowers: pedicels 6.5–16 mm long; sepals 2, chartaceous, elliptic to ovate or obovate, 6.5–17 × 4.5–12 mm, externally villous; petals 2, oblanceolate, 5.5–12.5 × 1–3.8 mm; stamens (19–)25–46; filaments 0.7–1.3 mm long inserted on a conspicuously raised torus; anthers narrowly oblong to obovate, 0.7–1.6 × 0.3–0.6 mm diam.; pistillate flowers: pedicels 3.5–9 mm long; bracteoles wanting; sepals 2, chartaceous, suborbicular to broadly transversely elliptic, 4.5–8 × 4.5–9 mm, externally villous; petal only 1, oblanceolate, 5–5.5 × 1.5–2 mm; ovary bilocular with bipartite placentae, 4–7.5 mm long, glandular and villous; styles 3, 1.5–2 mm long, fused only briefly basally; stigmas dilated-lunate with the ends just beginning to spiral to weakly bicornute, often with 1 of the 3 reduced; capsules with pedicels 6–12 (–14) mm long, 7–11 mm long; locules 4.2–6.5 mm long; wings 3, unequal, the largest asymmetrically triangular, 7–15 × 5.5–9 mm, marginally ciliate, the remaining 2 subequal, asymmetrically triangular, 2.5–5 × 5–9 mm.

Distribution and habitat. Known only from moist, forested stream- and riverbanks between 600 and 900 m elevation in Cartago Province, Costa Rica.

This is an attractive species with finely pustulate, often silver-variegated and discolored leaf blades. It is most similar to *B. carletonii* Standley, which occurs along the Caribbean coast of southern Costa Rica and western Panama. It may be distinguished readily from this latter species by its finely pustulate leaves and fine, spreading petiolar villi. Leaves of *B. carletonii* examined all lacked pustules and had a petiolar indument of stiff, strongly reflexed villi.

Paratypes. COSTA RICA. **Cartago:** Turrialba, across Río Reventazón from Interamerican Institute, 2000 ft., *DeWolf 194* (NY); between 9 and 12.5 km E of Tuis or 1.3–4.8 km W of Bajo Pacuare along rd. to Moravia de Chirripó, 800–900 m, *Utley 6014* (DUKE); about 2.3 km E of Tuis, Calle Rival along Río Tuis, *Utley & Utley 7259* (NOLS), *Utley & Utley 9036* (NOLS).

Acknowledgments. Fieldwork was made possible in part by grants from the American Philosophical Society, Standley Smith Horticultural Trust, and the Southwestern Region of the American *Begonia* Society. We thank the curators of the following herbaria for loans of specimens and use of facilities essential to this research: B, BM, BR, C, CAS, DUKE, F, G, GH, K, M, MEXU, MICH, MO, NY, US, XAL.

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Typification of *Batis maritima* L. (Bataceae)

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Abstract. No valid type designation for *Batis maritima* L. currently exists. A neotype for this name is therefore selected here to fix the application of the name.

The family Bataceae comprises a single genus, *Batis* P. Browne, which itself includes only two species, the generitype *B. maritima*, typified here, and *B. argillicola* P. Royen, a recently described species from Papua, New Guinea. *Batis maritima* was originally described by Patrick Browne (1756: 356) with the polynomial, "*Batis maritima erecta, ramosa; foliolis succulentis, subcylindricis.*" Linnaeus (1759: 1289) also provided a generic-species description adequate to validate his binomial, together with a reference to Browne. He appears to have taken this specific epithet from Browne's polynomial, and it seems likely that his knowledge of the plant was based on Browne's description. During preparation of an account of Bataceae for *Flora Mesoamericana* no valid type designation for the name was found.

Kellogg (in Howard, 1988: 42) cited Browne's description as type, but this does not conform to Article 8.1 of the *International Code of Botanical Nomenclature* (Greuter et al., 1994), which states that the type of a name must be a single specimen or illustration. Although valid at the time it was published under the then-current *Code* (Greuter et al., 1988), Kellogg's designation is now invalid. There is no accompanying plate in Browne's work, and no associated material has been traced in any of the Linnaean herbaria. Material from the Sloane herbarium (BM), which might be considered original material since Browne in his work refers to Sloane's Catalogue, cannot be considered eligible for lectotypification since it was never studied by Linnaeus. Neither would it make a suitable neotype due to the restricted access of the collection. No synonyms apart from that of Browne were cited by Linnaeus, and it appears, therefore, that there are no original elements for the name and that a neotype is required. The name *Batis maritima* is in current use and is taxonomically unambiguous. A neotype is therefore selected here to fix the application of the name in a way that maintains current usage.

Batis maritima L., Syst. Nat. (ed. 10) 2: 1289. 1759. TYPE: Jamaica. Middlesex: Clarendon Parish, near Tarentum farm, 10 ft., 3 Jan. 1960, *C. D. Adams 6063* (neotype, selected here by A. K. Monro, UCWI).

Acknowledgments. The work of the first author has been supported by the award of a grant by the Linnean Society of London to the Linnaean Plant Name Typification Project at The Natural History Museum. We thank Patrick Lewis of the University of the West Indies Herbarium for kindly lending material.

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New Species of Central American Araceae

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ABSTRACT. Five Central American species of *Dieffenbachia*, *D. beachiana* Croat & Grayum, *D. concinna* Croat & Grayum, *D. grayumiana* Croat, *D. hammelii* Croat & Grayum, and *D. tonduzii* Croat & Grayum, as well as one species of *Rhodospatha*, *R. pellucida* Croat & Grayum, are described as new.

Because of the impending completion of the *Flora de Nicaragua*, five names in *Dieffenbachia* and one in *Rhodospatha* must be published here in order to be included in that work. Revisions of both genera with additional new species (for Central America only for *Dieffenbachia*) are forthcoming.

Dieffenbachia beachiana Croat & Grayum, sp. nov. TYPE: Panama. Bocas del Toro: along road between Chiriquí Grande and Fortuna, 13.2 mi. W of Chiriquí Grande, 8°45′N, 82°10′W, 310 m, *Croat & Grayum 60130* (holotype, MO-3230653; isotypes, K, PMA, US).

Planta terrestris, 40–100 cm; internodia 2–6 cm longa, 1.5–3.5 cm diam.; petiolus 17–46 cm longus, vaginatus 1/4–8/10 longitudinis; vagina decurrens ad apicem; lamina anguste elliptica vel lanceolata, 16–41 cm longa, 6.5–15 cm lata. Inflorescentia 1–3 in quoque axilla; pedunculus 9–13 cm longus; spatha 10–19 cm longa; spadix usque 13–15 cm longus; pistila 48–66.

Slender herb 40–100 cm tall; stems briefly creeping at base; internodes 2–6 × 1.5–3.5 cm, medium green to olive-green, sometimes streaked with cream, semiglossy and obscurely roughened. Leaves clustered toward apex of stem, erect-arching; *petioles* 17–46 cm long (averaging 26.5 cm), broadly C-shaped in cross section, flat with acute, erect margins or sharply to bluntly sulcate adaxially, dark green to brownish, pale-green mottled, matte, usually minutely roughened and with scattered whitish raphide cells visible, drying with scattered clusters of pustular raised areas with granular-puberulent progressions; unsheathed portion (2.5–)10–30 cm long; sheaths decurrent distally, 10–22 cm long (averaging 14.2 cm), comprising 0.25–0.83% of the total length of the petiole (averaging 0.54% of petiole length); *blades* narrowly elliptic to lanceolate, rarely narrowly ovate, 16–41 × 6.5–15 cm, 1.8–5.3 times longer than wide, 0.7–1.9 times longer than petioles, inequilateral, one side 1–2 cm wider than the other, ± equilaterally acuminate at apex (acumen to 5 mm long), slightly inequilateral and acute, rounded or truncate at base (rarely subcordate in Panama), thinly coriaceous to subcoriaceous, drying papyraceous, usually quilted, weakly bicolorous, crisp-undulate along the margins; upper surface semiglossy (rarely matte), plain dark green (in Costa Rica, but sometimes mottled white or cream in Panama); lower surface slightly paler, semiglossy to weakly glossy or matte below; *midrib* flat-raised, often striate and usually concolorous above, convex or thicker than broad beneath; primary *lateral veins* 23–36 pairs, sunken above, convex beneath, drying paler than surface, departing midrib at an acute angle, then straight to weakly curved to the margin at 70°–110° before sweeping prominently toward apex (to ca. 45° toward apex and sometimes at the very base, sometimes with adjacent veins alternately reflexed and ascending); interprimary veins usually present, not markedly weaker than the primary lateral veins; midrib and primary lateral veins puberulent on lower surface with thick, whitish trichomes; minor veins moderately distinct and weakly raised beneath. Inflorescences 1–3 per axil; peduncles 9–13 cm long; spathe 10–19 cm long, uniformly green; gradually long-tapered to apex, gradually contracted at middle, which corresponds to the sterile section of the spadix; tube 1–2 cm diam. when furled; blade to 3 cm wide when flattened; spadix to 13–15 cm long; staminate portion of spadix 5–6.5 cm long, drying 4 mm diam.; male flowers 1.8–2.6 mm diam., irregularly subrounded, drying smooth and light brown at apex; pistillate portion of spadix 4.5–6 cm long, drying 7 mm diam., usually separated from the staminate portion by a slender, almost completely sterile section 2.0–3.5 cm long, drying 2 mm diam. (the staminate and pistillate portions sometimes almost contiguous); female flowers 48–66, 2–4 situated across the width of the spadix, pistils oblong-ellipsoid, 1.5–2.0 mm long, 1.0–1.6 mm diam.; stigma subglobular, about as broad as the ovary; staminodia narrowly clavate, usually not at all fused at base, ca. twice as long as pistil. Infructescence somewhat flattened, yellow-green

with darker flecking; spathe (10–)14–16 cm long, mottled green and white, eventually turning orange in fruit; fruiting spadix 6–10 cm long; berries orange, subglobose, 6–8 mm diam.

Dieffenbachia beachiana ranges from northeastern Costa Rica to western Panama (Bocas del Toro, Chiriquí, and Veraguas) at elevations of 40–800 m in tropical wet forest, premontane wet forest, and premontane rainforest: In Costa Rica it occurs on the Atlantic slope of the Central Cordillera and the Cordillera Talamanca, ranging from the Sarapiquí region to Tortuguero and Siquirres.

The species is characterized by its moderately thin, quilted blades with many broadly spreading primary lateral veins and crisped-undulate margins with the lower midrib and primary lateral veins puberulent.

Dieffenbachia beachiana is similar to *D. galdamesiae* Croat, sp. nov. ined., a species from central Panama that also has somewhat puberulent midribs on the lower blade surfaces. *Diffenbachia galdamesiae* differs in having the pubescence much shorter, merely granular-puberulent, and has fewer than 22 veins per side (vs. 23–36 for *D. beachiana*), which arise from the midrib at a 40°–60° angle. *Dieffenbachia beachiana* is also somewhat similar to *D. grayumiana*, but that species differs in having the veins merely minutely granular in slender rows on drying and in having somewhat more ovate blades.

Dieffenbachia beachiana initiates inflorescences in the late rainy season with plants reaching anthesis in the dry season (January through April). Immature fruits have been seen from April to September, and mature fruits have been seen from July to December.

The species is named in honor of James Beach, who first brought it to my attention while he was a Duke University student at the OTS Field Station at La Selva.

Paratypes. COSTA RICA. **Heredia**: area between Río Peje and Río Sardinalito, Atlantic slope of Volcán Barva, 10°18.5′N, 84°04′W, 480–520 m, *Grayum 6899* (MO); between Río Peje and Río Sardinalito, Atlantic slope of Volcán Barva, 10°17.5′N, 84°04.5′W, 700–950 m, *Grayum 6936* (MO); between Río Peje & Río Guácimo, trail from main road across Quebrada Cantarana to Río Guácimo, 250 m, *Grayum & Schatz 3220* (DUKE); between San José and Pto. Viejo, vicinity of Chilamate, 11.6 mi. N of Cariblanco, 10°27′N, 84°05′W, 100 m, *Croat 68358* (B, CR, MO); Finca La Selva, near Río Puerto Viejo, ca. 2 km upstream from confluence with Río Sarapiquí, 100 m, 10°06′N, 84°00′W, *Beach 1448* (DUKE), *Beach 1485* (DUKE, MO), *Burger & Stolze 5754* (CR, F), *Hammel 8122* (DUKE, MO), *Hammel 8846* (DUKE); Zona Protectora, N slopes of Volcán Barba, between Río Peje and Río Guácimo, 250 m, *Grayum & Schatz 3220* (DUKE); Sarapiquí, Finca La Selva, 100 m, *Croat 44283* (MO). **Limón:** La Colombiana Farm, United Fruit Company, 70 m, *Standley 36840* (US); between Río Pacuare and Quebrada Diablo, ca. 2.5 km E of Siquirres, 10°06′N, 83°29′W, 100–200 m, *Grayum et al. 7698* (MO); Parque Tortuguero Estación Agua Fría, 10°05′N, 83°34′W, 40 m, *Robles 1234* (CR, MO). **San José:** Vazquez de Coronado, Braulio Carrillo National Park, along San José to Siquirres Hwy., along trail to Río Sucio, site of the Old Carrillo Station, 600–700 m, 10°09′50″N, 83°57′10″W, *Croat 78771* (INB, MO, WU). PANAMA. **Bocas del Toro:** 10 km SW of Chiriquí Grande, 8°52′N, 82°10′W, 300 m, *Thompson 4937* (CM); Fortuna Dam–Chiriquí Grande, 7.3 mi. N of bridge over Fortuna Dam, 3.2 mi. N of Continental Divide, 8°45′N, 82°15′W, 700 m, *Croat & Grayum 60255* (MO); Fortuna–Chiriquí Grande Road, vic. of continental divide, 10 road-miles from continental divide and about 2 road-miles along road E of hwy., 08°55′4″N, 82°10′4″W, 300 m, *McPherson 11816* (MO), *McPherson & Aranda 10095* (MO); Fortuna–Chiriquí Grande, 7.7 mi. W of Chiriquí Grande, 1.5 mi. W of Punta Peña, 8°50′N, 8°10′W, 80 m, *Croat & Grayum 60094* (MO). CULTIVATED: Origin Costa Rica, *Henny 5* (MO).

Dieffenbachia concinna Croat & Grayum, sp. nov. TYPE: Costa Rica. Puntarenas: along road between Palmar Norte and Panamanian border 3 km N of jct. to Rincón, 8°48′39″N, 83°16′18″W, 110 m., 10 Sep. 1996, *Croat & Hannon 79191* (holotype, MO-05096177; isotypes, AAU, B, CAS, COL, CR, DUKE, F, GH, HUA, IMB, K, M, MEXU, NY, PMA, US).

Planta terrestris, 0.6–1.3 m; internodia 1.5–4.0(–7.5) cm longa, 1–4 cm diam.; petiolus 7.5–25(–35) cm longus, vaginatus 2/5–fere omnino; vagina 6.7–13(–20) cm longa; lamina elliptica, ovata-elliptica, raro ovata aut late lanceolata, 16–36 cm longa, (7.8–)10–15.5(–20.5) cm lata; nervis primariis lateralibus 6–12(–14) utroque; inflorescentia 2–8 in quoque axilla; pedunculus (2.5–)8–17.5 cm longus; spatha 11–25.7 cm longa; spadix 12–14 cm longus; pistila 42–65.

Small erect herb, 0.6–1.3 m tall; sap milky, typically lacking foul odor; internodes 1.5–4.0(–7.5) cm long, 1–4 cm diam., medium green to dark green, obscurely marbled with light to medium green, glossy; *petioles* 7.5–25(–35) cm long (averaging 17 cm long), moderately erect, semiglossy or almost matte, dark green to olive-green, blotched-striate or streaked with whitish or silver-green, drying greenish to sometimes light yellow-brown, sheathed from lower 2/5 to nearly throughout (averaging 0.63 the length of the petiole); sheath 6.7–13(–20) cm long (averaging 9.5 cm long), to 1.5 cm high, the margins erect to involute, asymmetrically auriculate to rounded and free-ending at apex, one side obtuse to rounded, the other acute to obtuse, the unsheathed portion 1–13 cm long, often solid green or whitish, terete and obtusely sulcate near the apex or subterete to C- or D-shaped, flat to

shallowly sulcate, the lateral margins rounded or sometimes acute; leaves erect-arching; *blades* usually ± elliptic, ovate-elliptic, rarely ovate or broadly lanceolate, 16–36 cm long, (7.8–)10–15.5(–20.5) cm wide (averaging 23 × 12 cm), usually broadest at or near the middle, 1.46–2.9 times longer than wide (averaging 2 times longer than wide), 0.8–2.4 times longer than the petiole, equilateral to slightly inequilateral (one side sometimes to 1.0 cm wider than the other), equilaterally acuminate at apex (the tip sometimes apiculate), broadly acute or usually rounded at base, slightly inequilateral, moderately coriaceous, weakly to moderately bicolorous, *upper surface* solid dark green or rarely whitish to cream or yellow-green-splotched or -flecked, semiglossy to glossy, drying dark olive-green, dark gray-green to yellowish brown above, *lower surface* moderately paler and matte to weakly glossy, drying yellowish brown to greenish, rarely dark gray-green; *midrib* flat to broadly flattened-convex and concolorous to paler above, sometimes pale in distal 1/3, low-convex to convex or rounded-triangular and paler to slightly paler below, drying light brown to dark brown but with the medial portion usually drying even darker; primary *lateral veins* 6–12(–14) per side, spreading at 45°–70° angle, sometimes arising at an acute angle, then spreading, only rarely at a different angle on opposite sides of the blade, weakly sunken above, convex to obscurely raised below, drying moderately inconspicuous and scarcely raised, yellow-brown, paler than or darker than surface, mostly concentrated in the lower 1/2; interprimary veins sometimes present, never more than 1 per pair of primary lateral veins, usually much less evident than the primaries; minor veins inconspicuous to visible and darker than surface. *Inflorescences* 2–8 per axil; peduncles (2.5–)8–17.5 cm long (averaging 10.5 cm long), somewhat dorsiventrally compressed, drying 3–4 mm diam.; *spathe* 11–25.7 cm long, 1.5–2.0 cm diam. when furled, constricted ca. 4.5 cm above the base, 4.5–8.5 cm wide on tube when flattened, 1.8–3 cm wide at constricted area when flattened, to 3.3 cm wide on blade when flattened, as long as or up to twice as long as the peduncle (averaging 1.6 times longer), medium to pale green outside, somewhat darker on tube except whitish on open face, uniformly paler within, drying dark brown to blackened; *spadix* 12–14 cm long, to 2 cm shorter than spathe, the free portion 6.5–9.5 cm long, protruding somewhat forward at anthesis; stipe and spadix axis pale green; pistillate spadix 4.5–9 cm long, 5–12 mm diam., narrowed slightly toward the apex; staminate portion of spadix white, 8–9 cm long, 7–10 mm diam., tapered slightly toward both ends; sterile staminate portion 2.5–4 cm long, 5–7 mm diam., mostly bare but with a scattering of staminodia at both ends (especially at base); fertile staminate portion of spadix 3.5–6.5 cm long, 7 mm diam., broadest at middle, tapered toward both ends; the flowers irregularly rounded, 0.8–1.4 mm diam.; female flowers 42–65, pistils globose, pale green, 1.0–2.5 mm diam., relatively closely spaced; stigmas pale yellow; staminodia 1–5 mm long, up to 3 times longer than the pistils, slender, somewhat flattened and free from one another at base, tapering and somewhat globular at apex, the tips to 1–2 mm diam. Infructescence with spathe yellow-orange to bright orange; spadix to 6 cm long; berries oblong-elliptic, bright red to orange-red, ca. 1 cm long, 8 mm diam.

Dieffenbachia concinna ranges from southeastern Nicaragua along the entire Atlantic slope and the Osa Peninsula of Costa Rica from sea level to 200 m, mostly at less that 100 m, sometimes locally common in rocky sites along streams. The species occurs in tropical wet forest and premontane wet forest.

The species is recognized by having all parts of the plant appearing glossy (on live plants), as well as by its relatively small stature, moderately coriaceous, more or less elliptic, weakly inequilateral blades, and auriculate petiolar sheath. It is most easily confused with *D. oerstedii* but differs from that species in its generally somewhat larger size, and more coriaceous blades typically broadest at the middle (vs. broadest below the middle in *D. oerstedii*) with more numerous primary lateral veins (9–14 vs. 4–11 for *D. oerstedii*). In addition, the blades of *D. concinna* are glossy above and at most rounded at the base, whereas they are typically weakly glossy to matte and frequently subcordate in *D. oerstedii.*

Flowering occurs mostly during the middle of the rainy season, from July through October, especially August and September, but may occur as early as March. A cultivated collection at the Missouri Botanical Garden flowered repeatedly over a two-week period during late May and early June. Collections with immature fruits have been seen from December to March. Mature fruits occur primarily from May through September, especially May to July, but have been seen as early as March.

Grayum et al. 10588, from the headwaters of the Río Piedras Blancas in Puntarenas Province, is unusual not only in occurring much higher (to 900 m) than most collections of this species but also in having a broader leaf (to 19 cm wide) with a longer petiole (to 30 cm). In other respects it agrees with other collections of *D. concinna.*

Paratypes. COSTA RICA. **Heredia:** near Puerto Viejo along road near Río Sucio, 20 m, *Croat 35702* (MO); Finca La Selva, OTS Field Station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 50–200 m, *Croat 78732* (INB, MO), *Grayum 2840* (DUKE), *Hammel 8784* (DUKE, MO), *Hammel 9688* (DUKE), *Hammel 9772* (DUKE), *Hammel 10081* (DUKE); near Puerto Viejo along road near Río Sucio, 20 m, *Croat 35688* (MO). **Limón:** La Colombiana Farm of the United Fruit Co., 70 m, *Standley 36739* (US); headwaters of Quebrada Mata de Limón, westernmost fork, Finca Anai (Sixaola region), 09°34′N, 82°39′W, 20–25 m, *Grayum et al. 4447* (MO); Parque Nacional Tortuguero, Cerro Tortuguero, 1–119 m, 10°35′N, 83°31′W, *Barringer et al. 1973* (F); Cerro Tortuguero junto a la Barra de Tortuguero, 10°35′N, 83°32′W, 60 m, *Robles 2090* (CR, INB, MO); Cerro Tortuguero, 119 m, *Gomez-Laurito 7856* (CR); Ref. Nac. Barra del Colorado, Río Chirripocito–Río Sardina, Ref. Nac. Barra del Colorado ("Sardinal" on Chirripo Atlantico quadrangle), 12 m, 10°38′N, 83°45′W, *Grayum 9777* (CR, MO); Río Reventazón, Finca Montecristo below Cairo, 25 m, *Standley & Valerio 48960* (US); Tortuguero National Park, near Boca de las Lagunas de Tortuguero, 10°34′N, 83°32′W, 0–30 m, *Burger & Antonio 11249* (F, MO); Cantón de Pococí, Refugio de Vida Silvestre Barra del Colorado, SE base of Cerro del Tortuguero, 10°35′N, 83°31′30″W, ca. 0–60 m, *Grayum et al. 11139* (CM, CR, INB, MO, USJ). **Puntarenas:** near Esquinas, along Panamerican Hwy., *McAlpin 85–33* (SEL); Orotina–Jacó, valley of Río Grande de Táracoles, 1 km S of Quebrada Ganado, 5 km S of bridge over Río Agujas on road to Jacó, 09°42′50″N, 84°36′30″W, 50 m, *Croat 79076* (INB, MO); Río Sándalo, 1–10 m, *Dodge & Goerger 10198* (F, MO), *Dodge & Goerger 10020* (F, MO); Cantón de Osa, Fila Costeña, Fila Cruces, headwaters of Río Piedras Blancas, Cerro Anguciana, 08°49′02″N, 83°11′25″W, 900–1000 m, *Grayum et al. 10588* (MO); Cantón de Osa, Fila Huacas, ca. 4 km NE of Panamerican Hwy. at Las Huacas (Venecia) along road to Sinaí, 08°52′00″N, 83°17′00″W, 400–500 m, *Grayum & Evans 10156* (MO); Río Riyito (valley of Laguna Chocuaco) and Quebrada Banegas, S of Cerro Rancho Quemado (ca. 7 km W of Rincón de Osa), 8°41′N, 83°32.5′W, 200–300 m, *Grayum et al. 7567* (MO); Rincón–Puerto Jiménez, 40 km W of Panamerican Hwy., 100 m, *Gómez 19531* (MO); near airport, 4 mi. W of Rincón de Osa, *Raven 21532* (F); along road from Panamerican Highway to Rincón, 10 km W of Interamerican Hwy., 08°45′08″N, 83°18′W, 200 m, *Croat & Hannon 79167* (MO); Rincón–Rancho Quemado, just S of Rincón near Río Rincón, 08°41′21″N, 83°29′00″W, *Croat & Hannon 79170* (HUA, IMB, MEXU, MO, QCA, RSA, WU); Rincón–Rancho Quemado, ca. 10 km W of main Rincón–Pto. Jimenez Road, 8°32′30″N, 83°32′W, 150–260, *Croat & Grayum 59785* (CR, MO); Palmar Norte vicinity, 30 m, *Allen 5669* (EAP, US); hills above Palmar Norte, 100–200 m, *Croat 35108* (MO); Quebrada Benjamín near crossing of trail from Palmar Norte to Jalisco, 8°58′00″N, 83°28′00″W, 160 m, *Grayum et al. 9962* (MO); Osa Peninsula, *Nicolson 3393* (US); 6 km W of Rincón, *Grant & Rundell 92–01928* (CR, MO, US); 4 mi. W of Rincón de Osa, 8°42′N, 83°31′W, *Burger & Stolze 5461* (CR, F); Rincón de Osa, ridge between Quebrada Aparicio and Q. Aguabuena, 200–400 m, 8°42′N, 83°31′W, *Grayum et al. 3982* (CR, MO), *3983* (CR, MO); ca. 5 km W of Rincón de Osa, 8°42′N, 83°31′W, 50–200 m, *Burger & Liesner 7196* (CR, F, PMA); vic. of Boscosa, at Quebrada Aguabuena, 50 m, 08°42′01″N, 83°30′48′W, *Croat & Hannon 79238* (COL, IMB, MO, PMA, EFH, TEX); Parque Nacional, Sector Esquinas, vicinity of Fila Gamba, hills behind Esquinas Rain Forest Lodge, along Quebrada Negra, at end of side road off of Villa Briceño to Golfito Road, 08°42′00″N, 83°12′30″W, 200–300 m, *Croat & Hannon 79291* (CM, DUKE, INB, MO, P, WU); Golfito–Villa Briceño Road, Río Cañaza, 08°39′30″N, 83°12′W, 80 m, *Grayum 9250* (MO); along shortcut road from Villa Briceño on Panama Hwy., W side of Villa Briceño, ca. 6 km from Golfito airport, less than 100 m, 8°41′30″N, 83°12′W, *Croat & Grayum 59930* (CM, K, MO); Golfito, Refugio de Vida Silvestre, 08°39′50″N, 83°10′40″W, 30–100 m, *Martén 789* (F); along highway to Golfito from Panamerican Highway at Río Claro, 2.5 mi. SE of Golfito, 8°36′N, 83°04′W, 60 m elev., *Croat & Hannon 67594* (AAU, CM, DUKE, F, JAUM, MO, MY, NY, P, QCNE, SA, SCZ, SEL, TEFH, VEN, US, W); Parque Nacional Corcovado, Lower Lookout Trail, 08°27–30′N, 83°33–38′W, 10–50 m, *Kernan 748* (CR); Monkey Woods, *Kernan & Phillips 831* (CR); Estación Sirena, S of Río Sirena along Río Camaronal, sea level, 08°28′N, 83°55′W, *Knapp 2165* (MO); Estación Sirena, 8°28′N, 83°35′W, 1–20 m, *Fco. Quesada 51* (MO); up to 1 km W of Sirena, 8°29′N, 83°36′W, *Liesner 2871* (CR, MO); Equinas Forest, 25 km SE of Palmar Sur, along Pan-Am Hwy., *Croat 78318* (MO); Interamerican Hwy., km 287, 2 km NW of Chacarita, 30 km S of Palmar Sur, 8°48′N, 83°17′W, 20–40 m, *Grayum & Fleming 8119* (MO); Cantón Coto Brus, Guaymí Indian Reservation, Río Limoncito near junction of Villa Palacios school trail, 680 m, *Koshear 59* (CR). NICARAGUA. **Río San Juan:** Reserva Indio-Maíz, 10°45′N, 083°59′W, *Rueda et al. 4070* (MO?).

Dieffenbachia grayumiana Croat, sp. nov. TYPE: Costa Rica. Limón: Refugio Nacional Barra del Colorado, forests and pastures between Río Chirripocito and Río Sardina ("Sardinal" on Chirripó Atlántico Quadrangle), 10°38′N, 83°45′W, 12 m elev., *Grayum 9773* (holotype, MO-4370212; isotype, INB).

Herba, 1–1.5 m; internodia 2.5–3.0 cm longa, 2–3.5(–10) cm diam.; petiolus subteres, (24–)30–59 cm longus, vaginatus 0.3–0.55 longitudinis; vagina decurrens ad apicem; lamina anguste ovata (22–)30–54 cm longa, 10–32 cm lata; nervis primariis lateralibus 13–18(–22); inflorescentia 1–3 in quoque axilla; pedunculus 8–12 cm longus; spatha 16.5–23.5 cm longa; spadix 15–27 cm longus; pistilla 125–160.

Stout herb, 1–1.5 m tall; stems erect at apical part, the older portion reclining for up to 1.5 m; internodes 2.5–3.0 × 2–3.5(–10) cm, dark green, glossy, variegated with cream-yellow or pale green (sometimes medium green with dark green lines as in *Croat & Grayum 60149*); *petioles* (24–)30–59 cm long, sheathed from 0.3–0.55 their length, matte, dark olive-green to deep brown, streaked or with cream-white in lower half, especially near the base, subterete, weakly flattened on upper surface toward the apex, sometimes slightly whitish adaxially and continuing whitish onto lower midrib; *sheath* 19–29 cm long, usually decurrent at apex, sometimes

weakly free-ending (as in *Croat & Grayum 60149*); *blades* narrowly ovate to oblong-ovate, (22–)30–54 × 10–32 cm, 1.5–2.6 times longer than wide, ranging from 0.6 as long as petioles to 1.4 times longer than petioles but averaging about as long as petioles, slightly inequilateral (one side 1–1.5 cm wider than the other), acuminate to abruptly acuminate at apex, inequilaterally subcordate (sinus to 2.5 cm deep) or rarely inequilaterally rounded at base (sometimes one side weakly subcordate, the other side rounded), subcoriaceous, drying thin and dark olive-green above, slightly concolorous to slightly bicolorous; *upper surface* usually glossy to semiglossy, dark green, drying dark olive-green, plain (unvariegated) to usually conspicuously mottled yellow-cream; lower surface semiglossy to nearly matte, slightly paler, plain to more weakly mottled cream drying yellowish green; *midrib* flat to weakly flat-raised or broadly convex (sometimes broadly sunken at base, broadly flat-raised and striate toward apex) slightly paler and dark-green-spotted to concolorous above, convex to narrowly rounded and whitish or narrowly acute and paler below; primary *lateral veins* 13–18(–22) per side, gradually arising at a steep angle from the midrib, then spreading in a broad curve at a 55°–80° angle (those near the apex to 25° angle, those near the base sometimes 90°–110° angle and sometimes forming a sigmoid curve), deeply sunken above, convex below, forming a series of weakly developed collective veins that eventually merge with the margin; at least the midrib sometimes minutely farinose-granular; minor veins moderately obscure below. *Inflorescence* 1–3 per axil, sometimes subtended by a reduced leaf with a fully sheathed petiole (the sheath emarginate at apex) and a reduced leaf blade 12–15 cm long, 3.5–6.5 cm wide; peduncle 8–12 cm long, drying 2–3 mm diam.; *spathe* 16.5–23.5 cm long, 3–4 cm longer than the spadix, 4.0–5.0 cm wide at base, to 2.5–3.5 cm wide at constriction, 2.5–3 cm wide on blade, up to 7 cm wide when flattened, uniformly light green to medium green on both surfaces, weakly glossy throughout outside, somewhat glossier within; *spadix* 15–27 cm long; pistillate portion 8.0–9.3 cm long, drying 7–10 mm wide; staminate portion 5–6.5 cm long, white, tapered toward apex and slightly toward the base; the staminate and pistillate portions separated by an almost sterile segment 2–2.5 cm long with a few scattered pistils in the lower half and a few scattered staminodia in the upper half; male flowers 1.2–1.6 mm diam., irregularly angled with rounded margins; female flowers ca. 125–160, pistils densely aggregated, separated from one another by 1/2 to 2.5 times their width, irregularly scattered with roughly 4–5 covering the width of the spadix, pale lemon-yellow, depressed-globose, 1.8–2 mm wide; staminodes white, 3–5 per pistil, free or briefly united at base, 1.5–2.2 mm long. Infructescence to 27 cm long, with fruiting portion 10–14 cm long; berries red-orange, subglobose, ovoid to ellipsoid, 5–7 mm diam.

Dieffenbachia grayumiana ranges along the Atlantic slope from northwestern Costa Rica to western Panama (then disjunct to northern Colombia), mostly near sea level but ranging up to 1300 m in Costa Rica in Alajuela Province (vicinity of Monteverde Reserve) and to 480 m in Heredia Province. It occurs in areas of tropical wet forest, premontane wet forest, and premontane rainforest. Grayum (pers. comm.) reported the species to occur mostly in light gaps and disturbed areas in primary forest at the La Selva Reserve in Costa Rica.

The species is characterized by its narrowly ovate, typically subcordate, mottled blades, weakly sheathed, decurrent petioles, and variegated stems and petioles. Also characteristic are blades that are frequently glossy on the upper surface and matte or nearly so on the lower surface. The major veins are sometimes minutely farinose-granular on the lower surface. In this regard it is perhaps related to *D. beachiana*, a species with puberulent major veins on the lower blade surface. Aside from pubescence type, *Dieffenbachia beachiana* also differs in having much narrower blades (1.8–5.3 times longer than wide) with 23–36 pairs of primary lateral veins.

A collection from Bocas del Toro Province in Panama (*Croat 74945*) differs in having larger concolorous blades (54 × 30 cm), which are only weakly glossy on the upper surface, with weakly sunken primary lateral veins. Another collection from Bocas del Toro, *Croat & Grayum 60149*, had stems to approximately 10 cm in diameter, substantially larger than those of any other collection reported.

Paratypes. COLOMBIA. **Chocó:** ca. 10–15 km S of Quibdó on road to Istmina (Panamerican Hwy.), and 8–10 km E on road to petroleum exploration camp, 5°35′N, 76°37′W, 90 m, *Grayum et al. 7657* (MO); Río Nercua, Quebrada Barrial–Quebrada Ambrosio, near Camp Curiche, *Duke 11471* (NY, OS); Río Truandó, *Schott 6* (NY). COSTA RICA. **Alajuela:** Upala Road, 5 km S of Canalete, near Río Zapote, 10°48′N, 85°02′W, 100–200 m, *Burger & Baker 9968* (CR, F); Monteverde Reserve, 1300–1400 m, *Dryer 1681* (F); Monteverde, upper Río Peñas Blancas, 9°17′N, 84°86′W, 1250–1350 m, *Burger et al. 10734* (CR, F). **Heredia:** Volcán Barva, area between Río Peje & Río Sardinalito, 10°18′30″N, 84°04′W, 480–520 m, *Grayum 6887* (MO); Río Sarapiquí, jenseits von La Virgen, 200–250 m, 1974, *Cl. Horich s.n.* (M); San José–Puerto Viejo,

vic. Chilamate, 11.6 mi. N of Cariblanco, 10°27′N, 84°05′W, 100 m, *Croat 68359* (B, MO); La Selva Biological Station, 10°26′00″N, 84°01′00″W, 50–150 m, *Beach 1440* (DUKE), *Beach 1441* (DUKE), *Burger & Matta 4181* (CR, F), *Croat 44226* (MO), *Croat 44321* (MO), *Croat 78733* (INB, MO), *Folsom 9724* (MO), *Grayum 2288* (DUKE), *Hammel 8167* (DUKE), *Hammel 8617* (DUKE), *Hammel 8835* (DUKE), *Hammel 8873* (DUKE), *D. Smith 597* (DUKE); N slopes of Volcán Barva, between Río Peje & Río Guácimo, *Grayum & Schatz 3206* (DUKE), *I Chacón 507* (DUKE, MO); Secondino's Woods, off Occidental, *Kress 84–1632* (SEL). **Limón:** Refugio Gandoca-Manzanillo, along Río Gandoca, 9°35″N, 82°36′W, 0–5 m, *Grayum et al. 8038* (MO); Guápiles–Guácimo, vic. Guácimo, 10°12′N, 83°43′W, 400 m, *Barringer 2432* (F); Cerro Coronel, E of Laguna Danto, 10°41′N, 83°38′W, 20–170 m, *Stevens 23642* (CR, MEXU, MO); Refugio Nacional Barra del Colorado, between Río Chirripocito & Río Sardina, 10°38′N, 83°45′W, 12 m, *Grayum 9830* (MO); Pococí Cantón, Parque Nacional Tortuguero, along Río Suerte between Palacios & Caño Penitencia, 10°33′N, 83°33–35′W, 10 m, *Grayum et al. 11116* (INB, MO), 10°29′N, 83°31′W, 8–25 m, *Grayum et al. 11163* (IMB, MO). **Puntarenas:** Río Piedras Blancas, Cerro Anguciana, 08°49′02″N, 83°11′25″W, 900–1000 m, *Grayum 10588* (CR, INB, MO). PANAMA. **Bocas del Toro:** W of Chiriquí Grande, < 50 m, *M. Akers 78A* (MO); Gualaca–Chiriquí Grande, 1.4 mi. S of Punta Peña, 0°55′N, 82°11′W, 200 m, *Croat 74945* (MO); Chiriquí Grande–Fortuna, 3 mi. W of Chiriquí Grande, 8°47′N, 82°09′W, ca. 10 m, *Croat & Grayum 60149* (MO); along railroad between Almirante and Chanquinola, Station Milla 5, 50 m, *Croat & Porter 16499* (MO).

Dieffenbachia hammelii Croat & Grayum, sp. nov. TYPE: Costa Rica. Heredia: Finca La Selva, the O.T.S. Field Station on the Río Sarapiquí, 50–80 m elev., *Grayum 7670* (holotype, MO-3491533; isotypes, B, CR, K).

Herba plerumque 25–40 cm raro usque 70 cm alta; internodia 3.5–7.5 cm longa, 0.5–2.0 cm diam.; petiolus 7–25(–35) cm longus, anguste C-formatus, non profunde sulcatus adaxialiter; lamina elliptica aut oblanceolata; costa plana et elevata adaxialiter; nervis primariis lateralibus 9–17 utroque; inflorescentia 1–3 in quoque axilla; pedunculus 4.5–11 cm longus; spatha (8–)10–12.5 cm longa. Baccae aurantiacae.

Small herb, mostly 25–40 cm (rarely to 70 cm tall); sap not foul-smelling; stem becoming decumbent and subrhizomatous at base; *internodes* 1–1.5 cm long on lower portions, 3.5–7.5 cm long toward apex, 0.5–2.0 cm diam., glossy, drying yellowish brown to gray-green, weakly striate; *petioles* 7–25 (–35) cm long (averaging 15 cm long), sheathed (0.3–)0.4–0.8 their length, plain green or mottled with dull yellow-green, drying matte, greenish or sometimes to yellowish brown, erect; sheath 5.5–13 cm long, narrowly decurrent at apex and sometimes difficult to discern where it ends; unsheathed portion 1–9 cm long (rarely to 15 cm), narrowly C-shaped to D-shaped, shallowly sulcate adaxially, the margins finely acute; *blades* erect-arching, narrowly to broadly elliptic or oblanceolate, slightly inequilateral (one side 0.5–1.0 wider) (the narrower side usually plane, the wider side usually minutely undulate), 9–28 × 3.2–13(–15) cm, 1.7–3.4 times longer than wide (averaging 2.7 times longer than wide), acuminate at apex, narrowly to broadly acute or attenuate and equilateral or slightly inequilateral at base, rarely obtuse, thinly coriaceous, slightly to moderately bicolorous; *upper surface* plain medium green to dark green and weakly glossy to semiglossy, drying light yellow green to dark brown; *lower surface* slightly to moderately paler, weakly glossy to essentially matte, drying usually yellow-green, sometimes yellow-brown; *midrib* flat-raised or rarely convex (sometimes obscurely sulcate medially) and slightly paler above, convex to narrowly convex below, 1–3 mm diam., drying pale brown, matte, with short, white raphide cells; primary *lateral veins* 9–17 per side, moderately obscure, arising at 40°–50° angle, weakly curved to the margins, weakly sunken or slightly raised in weak valleys, weakly quilted and concolorous above, convex and weakly pleated-raised below, moderately inconspicuous on drying, slightly darker or slightly paler than surface; interprimaries about as conspicuous as the primary lateral veins; minor veins and cross-veins clearly visible, and darker than lower surface, moderately faint on drying. Inflorescences 1–3 per axil; peduncles 4.5–11 cm long, subterete; *spathe* (8–)10–12.5 × 1.2–1.5 cm, to 3 cm wide when flattened, 1.4–2.7 times longer than peduncle, long-attenuate above tube, cuspidate to acuminate at apex, uniformly medium-green outside and inside; *spadix* 6.5–12.5 cm long; staminate portion moderately acute at apex, tapered to both ends, (1.7–)3–4.5 cm × 6–7 mm (dried); male flowers bluntly 4–5-sided, irregularly shaped toward the base, more nearly rounded toward the apex, 2–2.5 mm diam.; pistillate spadix 5–8.5 cm long (fused with spathe for up to 4 cm), 6–7 mm wide; female flowers 26–31, sparse, separated from the staminate portion by a sterile section (0.8–)2.0–3 cm long, this with only a few scattered sterile male flowers; pistils ovoid, loosely scattered in clusters of 2–4 with up to three across the width of spadix but often with spaces between the groups of pistils up to twice the width of the spadix; staminodia up to twice as long as pistils, free from one another at base and drying flattened and very thin. Infructescence with spathe pale orange, to 22 cm long; berries orange to bright red, oblong-ellipsoid, ca. 1 cm long, 8 mm diam.

Southeastern Nicaragua (Depto. Río San Juan)

and northern Costa Rica from sea level to 100 m in the tropical wet forest life zone, in wet forests and swampy areas on the Atlantic slope.

The species is characterized by its small stature, glossy, decumbent, subrhizomatous stems, weakly sheathed, matte-drying petiole (decurrent at apex), and moderately small, more or less oblong-elliptic, weakly inequilateral plain green leaf blades with moderately numerous primary lateral veins, and with one blade margin plane and one minutely undulate.

In Costa Rica *Dieffenbachia hammelii* is most easily confused with *D. oerstedii* or smaller plants of *D. grayumiana*, both of which can be distinguished in having the petiolar sheath auriculate at the apex rather than decurrent as in *D. hammelii*. At La Selva, where the species was first studied, *D. hammelii* is uncommon. One collection (*Hammel 8784*) reported that the sap was not foul-smelling, although many species in the genus are.

Flowering plants have been seen from March through May while mature fruits have been seen in September. Cultivated plants at the Missouri Botanical Garden flowered in mid July and mid October.

Paratypes. COSTA RICA. **Heredia:** La Selva Biological Station, 10°26′N, 84°01′W, 50–200 m, *I. Chacón 553* (F), *Croat 78731* (INB, MO), *Folsom 9329* (DUKE), *Grayum 2772* (DUKE, MO), *Hammel 8212* (DUKE), *Hammel 8273* (DUKE), *Hammel 8748* (DUKE, F, MO), *Hammel 12320* (MO). **Limón:** Cerro Coronel, E of Río Zapote, within 1 km of Río Colorado, 10°40′N, 83°40′W, 10–40 m, *Stevens et al. 24699* (CR, MO), *Stevens 24257* (CR, MO); 2–3.5 airline km SSE of Islas Buena Vista in the Río Colorado, 14–16 airline km SW of Barra del Colorado, 10°40′N, 83°40′W, 10–120 m, *Davidse & Herrera 31077* (CR, MO), *Davidse & Herrera 31213* (MO); Refugio Barra del Colorado, Río Chirripocito–Río Sardina ("Sardinal" on Chirripo Atlantico quadrangle), 10°38′N, 83°45′W, 12 m, *Grayum et al. 9744* (CR, MO); Tortuguero National Park, near Boca de las Lagunas de Tortuguero, 10°04′N, 83°32′W, 0–30 m, *Burger & Antonio 11224* (F); Cantón de Pococí, Parque Nacional Tortuguero, northern terminus of Lomas de Sierpe, S from Río Tortuguero, 10.29N, 83.31.30W, ca. 8–25 m, *Grayum et al. 11169* (CR, INB, MO). **San José:** Vázquez de Coronado, 600–700 m, Braulio Carrillo National Park, San José–Siquirres Hwy., trail to Río Sucio, site of the Old Carrillo Station, 10°09′50″N, 83°57′10″W, *Croat 78758* (INB, MO, WU). NICARAGUA. **Río San Juan:** near Caño Chontaleno, 20 km NE of El Castillo, 200 m, *Neill & Vincelli 3484* (MO).

Dieffenbachia tonduzii Croat & Grayum, sp. nov. TYPE: Panama. Bocas del Toro: vic. Valle de Silencio, along Río Changuinola, ca. 1 km above mouth of Río Teribe, vic. Teribe Indian population, disturbed forest among cacao plantations, 9°21′45″N, 82°31′45″W, <100 m, 25 June 1994, *Croat & Zhu 76452* (holotype, MO-04611212; isotypes, AAU, B, CAS, COL, CR, DUKE, F, GH, HUA, IMB, K, M, MEXU, NY, PMA, SCZ, US, VEN, WU).

Herba 0.5–1.5 m alta; internodia 1.5–4.5(–6) cm longa, 1.5–3(–4.5) cm diam.; petiolus 10–24 cm longus, vaginatus ubique, vagina rotundata inaequaliter apice, saepe imbricata laminae basi; lamina inaequilatera, ovata vel ovato-elliptica aut oblanceolato-elliptica, (15–)25–48(–63) cm longa, (8–)15–32 cm lata, basi plerumque inaequaliter subcordata. Inflorescentia 1–4, pedunculus (1–)6–17 cm longus, usqua ad 6 cm diam. (in sicco); spatha viridis, cum tubo 2–2.5 cm diam. (in sicco); spadix pistillatus 8.5–9.5 cm longus; cum parte pistillata aggregata praeter summum 1–1.5 cm.

Terrestrial herb 0.5–1.5 m tall, usually to less than 1 m tall; internodes usually solid dark to medium green, sometimes faintly marbled with gray-green or yellowish gray throughout (on plants that also have streaked petioles), initially weakly glossy, becoming semiglossy to glossy, often with a subvelvety sheen, 1.5–4.5(–6) cm long, 1.5–3(–4.5) cm diam., the petiole scars manila to whitish, curved downward on the opposite side of the stem and ending unevenly; *petioles* 10–24 cm long (averaging 17.6 cm long), held ± erect, medium green (except sometimes white to pale green at base), almost matte to weakly glossy, weakly striate (especially near the base), narrowly rounded to obtusely angular on abaxial surface and often whitish medially, sometimes streaked in a variegated pattern throughout (this whitish coloration continuing onto the midrib), sheathed virtually throughout; sheath erect to involute (rolled inward throughout in age), free-ending and unequally rounded at apex, prolonged to 2 cm beyond the base of blade; unsheathed part obsolete or rarely to 1 cm long (when evident obtusely flattened); *blades* inequilateral (one side 1–3.0 cm wider), ovate to ovate-elliptic or oblanceolate-elliptic, (15–)25–48(–63) cm long, (8–)15–32 cm wide, (averaging 34 × 16 cm), broadest near the middle, sometimes below, frequently above the middle, 1.4–2.5(–3.5) times longer than wide (averaging 2.1 times longer than wide), 1.9–3 times longer than petioles, spreading to erect-spreading, gradually to abruptly acuminate, sometimes acute at apex, inequilaterally cordulate at base, one side sometimes broadly rounded to obtuse, the other side cordulate, sometimes inequilaterally acute, subcoriaceous, often conspicuously quilted, moderately bicolorous; *upper surface* usually solid dark to medium green, sometimes conspicuously to sparsely variegated with pale green or pale yellow throughout much of the surface, the mottling large or small, but somewhat restricted to the area midway between the midrib and margin, matte to weakly glossy, sometimes appearing weakly velvety, drying gray-green to olive-green or dark brown; *lower surface* much paler and matte to weakly glossy, silvery-green, drying yellowish green to

yellow-brown below; *midrib* flat to broadly rounded and moderately to strongly paler, pale green or sometimes creamy white above (sometimes only toward the apex), bluntly acute to obtusely angular and paler, sometimes whitish or creamy white below, (0.6–)1–1.7 cm wide; primary *lateral veins* (14–)18–25(–30) per side, arising at an acute angle with the midrib and spreading at 45°–90°, sometimes reflexed toward the base, prominently to weakly and obtusely sunken above, convex to weakly raised and darker than surface or concolorous below, some of the lowermost with a weak fold near the base (*Croat & Grayum 60112*), sometimes convex-pleated below; interprimary veins almost as conspicuous as the primaries; minor veins moderately to distinctly visible, darker than surface below. Inflorescences 1–2(–4) per axil, often with two oriented in opposite directions; *peduncle* (1–)6–17 cm long (averaging 10.3 cm long), 7–8 mm diam., weakly glossy, dark to medium green, sometimes with pale yellow-green streaks; *spathe* (12–)15–28 cm long (averaging 20 cm long), 2–4 times as long as peduncle, acuminate at apex, convolute to about the middle in lower part, matte to weakly glossy outside, glossy within, solid medium green on both surfaces, gradually and weakly constricted somewhat above the middle; spathe tube 1.5–3.0 cm diam. when closed, 6.8–9 cm wide when flattened; constricted area 4.3–4.5 cm wide, flattened *spadix* (9–)16.5–25.5 cm long, about as long as or up to 3.0 cm shorter than the spathe; free portion 7.8–8.5 cm long; pistillate portion (4.8–)6–11.5 cm long; mostly sterile portion sparsely flowered to naked (rarely lacking, as in *Croat 70768*), 1.8–4.0 (–8.5) cm long with 0.6–1.5 cm totally bare, the uppermost portion with a few staminodia, sometimes with a few scattered staminodia throughout, the lower half sometimes with an occasional pistil and much reduced staminodia, rarely with the female flowers ± equidistant and nearly contiguous with staminate part; fertile staminate portion (4–)5.5–10 cm long, 7–10 mm diam., slightly broader midway, weakly tapering to apex and base, bluntly pointed at apex; male flowers 5–6 per spiral, ± rounded in outline, crenulate along margins, truncate at apex; sterile male flowers irregularly shaped, 1.8–2.5 mm diam.; pistillate portion of spadix to 11 cm long, 9–10 mm diam.; *female flowers* (15–)48–62, closely aggregated except in the upper 1.5 cm of spadix, 4–5 in the width of the spadix (uppermost pistil borne on an almost bare segment of the spadix); pistils pale cream-yellowish to pale yellow-green, smooth, 2.3–3.5 mm diam.; style (after stigma has fallen) sharply cupuliform, 1.5–1.7 mm diam., with a single central pore, stigmas yellow; staminodia clavate, white, 2–3 mm long, mostly contiguous and sometimes fused at base; fruiting spathe pale yellow; berries red to red-orange, 5–8 mm diam.

Dieffenbachia tonduzii ranges from southeastern Nicaragua to the Pacific slope of Colombia (Antioquia, Chocó, Cauca, Valle) and Ecuador (Esmeraldas, Loja, and Los Ríos), from sea level to 1400 m, in tropical wet forest, premontane wet forest, and premontane rainforest in Central America and in tropical wet forest and pluvial forest and pluvial premontane forest and tropical wet forest transition to premontane in Colombia.

The species is characterized by its fully sheathed petioles, usually matte to weakly glossy, sometimes weakly velvety blades with cordulate bases and numerous, broadly spreading primary lateral veins. Because of the fully sheathed petioles it can be confused only with *D. horichii* Croat, sp. nov. ined., and *D. longispatha* var. *creberipistila* Croat, var. nov. ined. Both of the latter typically have much larger leaves that are not at all cordulate at the base (though they are rarely broadly and weakly subcordate). *Dieffenbachia tonduzii* is polymorphic with regard to leaf markings in the same way as *D. oerstedii* and is quite variable in all respects. It appears to hybridize with *D. oerstedii*.

Dieffenbachia tonduzii is similar to *D. daguensis* Engler, a Colombian species described from less than 200 m elevation on the Río Dagua in Valle Department. *Dieffenbachia daguensis* also has many rather close primary lateral veins and a fully sheathed petiole, but differs in having the staminate and pistillate sections of the spadix contiguous or nearly so. In addition, it differs in having much shorter petioles (described as being up to 5 cm long).

A South American species, *D. parlatorei* Linden & André, also sometimes has petioles fully sheathed but differs from *D. tonduzii* in having leaf blades usually broadest above the middle, semiglossy on the lower surface, and the midrib often broadly rounded and spongy. It also has the primary lateral veins arising at a 40°–60° angle from the midrib (vs. often at more than 60° and sometimes up to 90° in *D. tonduzii*).

Croat 70900, from 250 m in Chocó Department, Colombia, appears to be *D. tonduzii*, but differs in several ways. It has leaves with the midrib flat-raised above with the margins undercut. It also has stems that appear scurfy (though weakly glossy if rubbed clean). Another difference is that the petiole sheath is more prominently free-ending and sub-

acute at the apex. In addition, the free portion of the petiole is broadly and sharply sulcate.

A collection from Bajo Calima (Valle Department, Colombia), *Croat 79768*, differs in having no sterile segment, with the staminate and pistillate flowers being closely contiguous. It otherwise resembles this species.

Dieffenbachia tonduzii is named in honor of Adolfo Tonduz (1862–1921), who made the first collection of the species in December 1898.

Paratypes. COSTA RICA. **Alajuela:** Cantón de Alajuela, Río Sarapiquí, junction of road to Virgen del Socorro, 10°15′30″N, 84°10′30″W, 700–830 m, *Grayum & Murakami 9939* (CR, MO), 830 m, *Croat 68336* (MO), *Stevens 13564* (MO), San Ramón–Bajo Rodríguez, vicinity of Km 19.5 NW of San Ramón, 10°11′N, 84°30′W, 925 m, *Croat 78838* (MO); San Ramón–Bajo Rodríguez, near Río Cataratitas, 10°12′30″N, 84°32′W, 850 m, *Croat 68097* (MO); San Ramón–Bajo Rodríguez, 36–37 km NW of San Ramón, 10°15′N, 84°34′W, 500–515 m, *Croat 68196* (MO); San Ramón–Fortuna, km 26, N of Fortuna, 600 m, *D. Smith et al. 1059* (DUKE); San Ramón–San Lorenzo, 4–7 km N of Balsa, 10°13′N, 84°32′W, *Liesner & Judziewicz 14797* (MO); San Ramón–Fortuna, km 25 N of San Ramón, 600 m, *D. Smith et al. 1059* (MO); Naranjo–Aguas Zarcas, 8 km NE of Quesada, 600 m, Hwy. 15, *Croat 46945* (MO); Finca Los Ensayos, 11 km NW of Zarcero, 850 m, *Croat 43629* (MO); Volcán Arenal, trail above Río Agua Caliente, *Funk et al. 10626* (CR), *Funk et al. 10718* (CR); Cañas–Upala, 4 km NNE of Bijagua, vic. of Río Zapote, 400 m, *Croat 36260* (MO); 10 km N of Bijagua, 200 m, *Croat 36472* (MO); Bosque Eterno de Los Niños, Río Peñas Blancas valley, Laguna Poco Sol, *Haber & Zuchowski 11175* (MO). **Cartago:** Río Las Vueltas, Tucurrique, 635 m, *Tonduz 12874* (US); Camino Raiz de Hule, SE of Platanillo (Tsipirí), 1200–1400 m, *Croat 36727* (MO), *Croat 36747* (MO), *Croat 36821* (MO); Finca El Cedral, Orosi, Río Naranjo, 9°48′N, 83°52′W, 1400 m, *Lent 4042* (F, MO, NY, SEL); Monumento Nacional Guayabo, Turrialba, Santa Teresita, above Ríos Guayabo, Lajas & Torito, 9°57′N, 83°41′30″W, 700–1800 m, *Rivera 1718* (CR, K); Cañon de Río Orosi I, *Chacón et al. 1488* (CR, MO); Monumento Nacional Guayabo, Turrialba, 9°58′20″N, 83°41′45″W, *A. Pérez 1* (CR); 1.5 mi. E of Cachi, 10.2 mi. NE of junction of main road at Paraíso, *Croat 47088* (MO); Cartago Cantón, Río Reventazón at CATIE, Turrialba, 9°53′30″N, 83°39′W, 510–630 m, *Grayum et al. 9469* (CR, MO, NY), 630 m, *Lent 639* (F), 540 m, *Lent 694* (F); 3 km E of Turrialba, "Los Espaveles" nature trail, Río Reventazón, 9°54′N, 83°39′W, 525–600 m, *Liesner et al. 15330* (MO); Turrialba–Limón, 24 km NE of Turrialba, 1.5 km E of Tres Equis, 9°58′N, 83°34′W, 450–525 m, *Liesner et al. 15365* (MO); 12 air km S of Turrialba, 4 km SE of Pejibaye along Río Gato, 9°48′N, 83°42′W, 700 m, *Liesner 14394* (MO); Parque Nacional Tapantí, Sendero Oropéndola, 9°45′40″N, 83°47′27″W, 1100 m, *Nilsson et al. 632* (CR), 09°54′06″N, 83°47′27″W, 1200–1300 m, *Nilsson et al. 377* (CR). **Guanacaste:** Cordillera de Guanacaste, Rincon de la Vieja, NW of Quebrada Grande, 500 m, *Barringer et al. 4039* (F); El Arenal, 485–600 m, *Standley & Valerio 45206* (US), *Standley & Valerio 45262* (US). **Heredia:** Occidental Sendero, *Kress 84–1630* (SEL); 8 km E of San Ramón, 10°20′N, 84°04′W, *Loiselle 106* (MO); La Selva Reserve, *Croat 44317* (MO), *Folsom 10116* (DUKE), *Grayum 2780* (DUKE, F, MO), *Hammel 8874* (DUKE, F, MO), *Schatz & Grayum 706* (DUKE); near Puerto Viejo, along road to Río Sucio, 20 m, *Croat 35682* (MO), *Croat 35753* (F, MO); N slopes of Volcán Barba, between Río Peje & Río Guácimo, along Quebrada Cantarana, 300–400 m, *Grayum & Schatz 3174* (MO). **Limón:** Finca Castilla, 30 m, *Dodge & Goerger 9489* (MO); forests of Suerre and Dos Bocas, drainage of Río Parismina and Reventazón, sea level, *Shank & Molina 4288* (EAP); Finca Montecristo on Río Reventazón below Cairo, ca. 25 m, *Standley & Valerio 48999* (US); Río Segundo, Asunción 500–600 m, *Gomez et al. 23477* (MO); Reserva Indígena Talamanca Sukut, mouth of Río Sukut at Río Urén, 9°24′30″N, 82°58′15″W, *Hammel et al. 17548* (MO); Finca Anai, Quebrada Mata de Limón (Sixaola region), 9°35′N, 82°39′W, *Grayum & Schatz 5279* (CR, MO); Refugio Barra del Colorado, between Río Chiripocito and Río Sardina, 10°38′N, 83°45′W, 12 m; *Grayum 9804* (CR, MO); Parque Nacional Tortuguero, Lomas de Sierpe, 4 km NE of the P.N. over the Río Sierpe, 10°24′N, 83°33′W, 10°25′N, 83°34′W, 40–100 m, *R. Robles 2050* (CR, G, MO); Parque Tortuguero, Estación Agua Fria, *Robles 1142* (CR), *Robles 1158* (CR, MO); Tortuguero Cantón, Bribrí–Suretka, 100–200 m, *Barringer et al. 3525*; between Bribrí and Sixaola, NW of Paraiso, 20–70 m, 82°40′W, 9°39′N, *Barringer et al. 3479* (CR, F); Limón–Shiroles, along Río Sixaola, 0.9 mi. SW of Bambu, 6.5 mi. SW of Bribrí, 50 m, *Croat 43298* (MO); Río Catarata between Bribrí & Río Sixaola, 9°37′N, 82°49′W, 50–100 m, *Baker & Burger 90* (F, MO); ca. 10 km S of Punta Cahuita, ca. 3 mi. S of turnoff to Bribrí, 70 m, *Croat 43201* (MO); 7 km SW of Bribrí, 100–250 m, *Gomez et al. 20405* (B, MO); near Río Sixaola, ca. 1/2 mi. SW of Bambú, ca. 3 mi. NE of Bratsi, 15 m, *Croat 43266* (CR, MO); Guápiles, bosques de Toro Amarillo, 300 m, *León 720* (CR, F); Cantón Limón, headwaters of Quebrada Kakébeta below divide between Río Xikiari and Río Boyei, 9°47′00″N, 83°20′30″W, 900–1000 m, *Grayum 10858* (MO); Turrialba–Limón, 11 mi. S of Siquirres, 650 m, *Croat 43333* (MO). **San José:** Vazquez de Coronado, Braulio Carrillo National Park, San José to Siquerres Hwy., trail to Río Sucio, site of the Old Carrillo Station, 10°09′50″N, 83°57′10″W, 600–700 m, *Croat 78787* (MO); Puerto Viejo, near Río Sucio, 20 m, *Croat 35753* (MO); La Hondura, 1300–1700 m, *Standley 36314* (US). NICARAGUA. **Rivas:** Isla Ometepe, NW slopes of Volcán Maderas, 11°26–27′N, 85°30–31′W, 1000–1350 m, *Stevens 6511* (MO). **Zelaya:** road to Colonia Manantiales (Colonia Somoza), 6.3 km S of bridge at Colonia Yolaina, 11°36–37′N, 84°22′W, 200–300 m, *Stevens 6420* (MO); Río Punta Gorda, Atlanta, mouth of Caño el Guineo, 11°33′N, 84°02′W, 10 m, *Moreno & Sandino 12855* (MO), *Sandino et al. 4875* (MO); Río Punta Gorda, Atlanta, 2 km al S de Carolina del Sur, 11°32′N, 84°01′W, 60 m, *Moreno & Sandino 12891* (MO); Río Punta Gorda, Atlanta, Caño Negro en la desembocadura del Río Chiquito, 11°35′N, 84°00′W, 30 m, *Moreno & Sandino 12917* (MO); Río Punta Gorda, Atlanta, desembocadura del Caño del Oro en el Río Chiquito, 11°36′N, 84°00′W, 10 m, *Moreno & Sandino 12955* (MO); Río Punta Gorda, Caño El Guineo, *Téllez et al. 4875* (CR, MEXU, MO). PANAMA. **Bocas del Toro:** along Continental Divide trail, 1.1 mi. from main highway, 8°44′N, 82°17′W, *Croat 60355* (MO); Continental Divide trail, 8°45′N, 82°15′W, *McPherson 9865* (MO); Almirante–Ojo de Agua, 3–6 mi. W of Almirante, 30–200 m, *Croat 38229* (F, MO); Valle del Silencio, along Río Changuinola, ca. 1 km above mouth of Río Teribe,

vicinity Teribe Indian population, 09°21′40″N, 82°31′40″W, < 100 m, *Croat & Zhu 76450* (MO); Chiriquí Grande–Fortuna, 1 mi. N of Continental Divide, 950 m, *Churchill & Churchill 6252* (MO); 1.6 mi. N of Continental Divide, 08°48′N, 82°13′W, 850 m, *Croat 74930* (MO); 13.2 mi. W of Chiriquí Grande, 8°45′N, 82°10′W, 310 m, *Croat & Grayum 60139* (B, MO, PMA); N of Fortuna Dam, 08°45′N, 82°15′W; 450–700 m, *McPherson 11129* (MO), *McPherson 7371* (MO); 6.6 mi. N of bridge over Fortuna Dam, 8°45′N, 82°18′W, 780 m, *Croat 66732* (MO); Fortuna–Chiriquí Grande, 8.1 km S of Punta Peña, 08°49′N, 82°13′W, *Croat 74952* (MO); 1.5 km W of Punta Peña, 8°50′N, 82°10′W, 80 m, *Croat & Grayum* (MO); Río Cricamola, between Finca St. Louis & Konkintoë, 10–15 m, 460 m, *Woodson et al. 1909* (F, MO); Almirante–Chanquinola railroad, mile 7.5 S of Changuinola, < 100 m, *Croat & Porter 16249* (MO); Changuinola, forest near Luzon, *Kennedy 3253* (MO). **Chiriquí:** Gualaca–Fortuna, 7.9 mi. NE of Los Planes de Hornito, 8°44′N, 82°16′W, 1300 m, *Croat 49932* (MO); 7.7 mi. NW of Los Planes, 1400 m, *Croat 48778* (MO); 7.9 mi. NW of Los Planes, 8°44′N, 82°16′W, 1300 m, *Croat 49932* (MO); 10 mi. NW of Los Planes de Hornito, 8°45′N, 82°17′W, 1260 m, *Croat 50049* (MO); vic. Fortuna Dam, valley of Río Chiriquí, along aquaduct for IRHE facilities, 8°45′N, 82°18′W, 1200–1300 m, *Croat 66533* (B, DUKE, MO, NY, US); Fortuna Dam area, 5.3 mi. N of center of dam, 1.4 mi. W of main road near Continental Divide, 08°44′N, 82°17′W, *Croat & Zhu 76328* (MO); 4.5–5 km N of dam over Fortuna Lake, 8°43′N, 82°17′W, km 111, more than 500 m, *Gordon 339* (PMA). **Veraguas:** NW of Santa Fe, 11 km N of Escuela Agrícola Alto de Piedra, 450–500 m, *Croat 27490* (MO), *Cochrane et al. 3817* (F); 0.6 mi. N of Escuela Agrícola Alto Piedra, 730–735 m, *Croat & Folsom 33989* (MO), *Croat & Folsom 34042* (MO); 1 hour walk NW of Escuela Agrícola, 3000′, *Antonio 2994* (MO); trail to summit of Cerro Tute, ca. 3 km above Escuela Agrícola Alto Piedra, 1050–1150 m, *Croat 48903* (MO), 2600–2800′, *Sytsma & Antonio 3006* (MO); trail to summit of Cerro Tute, 8°33′N, 81°08′W, 800–950 m, *Croat 66993* (MO); mountains 3–5 mi. N of Santa Fe, 500–1000 m, *Gentry 3035* (MO); along 1st stream N of Escuela Agrícola Alto Piedra, 700 m, *Croat 49070* (MO). COLOMBIA. **Antioquia:** Murrí–La Blanquita, Río Murrí, 06°35′N, 76°50′W, *Gentry et al. 75903* (MO). **Cauca:** Coteje, Río Timbiquí, *Lehmann 8876* (K). **Chocó:** Quebrada Antón, 15 km W of Santa Cecilia, 6 km W of Chocó–Risaralda border, 20 km E of Playa del Oro, 05°20′30″N, 76°13′45″W, 240 m, *Croat 70900* (MO); Serranía de Baudó, Las Animas–Pato, Río Pato, ca. 4 km SW of Pato on property of Sr. Guttierez, 5°30′N, 76°46′W, 150 m, *Croat 56112* (CHOCO, MO); Río Pichimá, Communidad indigena Waunana, 4°25′N, 77°17′W, 100 m, (COL, MO); Quibdó–Medellín, at Km 185, 14 km E of Tutunendo, 5°44′N, 76°43′W, 300 m, *Croat 56282* (CHOCO, MO); km 208.5, 9 km W of Tutunendo, 5°39′N, 76°40′W, < 100 m, *Croat 56205* (COL, JAUM, MO); km 85 W of Bolívar, 350 m, *Croat 49310* (MO); San José del Palmar–Novita, vicinity of Santa Rosa at end of existing road, 4°57′N, 76°30′W, 350 m, *Croat 56625* (MO); Quibdó–Medellín, 25 mi. E of Quibdó, 200 m, *Croat 52300* (MO); ca. 2 km E of Playa de Oro, 5°20′N, 76°23′W, 200 m, *Croat 57427* (CHOCO, MO); Pueblo Rico (Risaralda) to Istmina (Chocó), 1 km W of Guarato and Río Guarato at Risaralda and Chocó border, 285 m, *Croat 70868* (CM, MO); E side of Serranía del Darién, approach from Acandí, 8°30′N, 77°20′W, 160 m, *Juncosa 619* (MO). **Valle:** Cordillera Occidental, western slopes, Río Digua, Piedra de Moler, 900–1180 m, *Cuatrecasas 15053* (US). ECUADOR. **Esmeraldas:** Cantón Eloy Alfaro, Comuna de Corriente Grande (Río Chimbagal, tributary of Río Cayapas), 00°41′N, 78°50′W, 150–200 m, *Yáñez et al. 1387* (MO); Reserva Ecológica Cotacachi-Cayapas, Charco Vicente, Río San Miguel, 00°43′N, 78°53′W, 150 m, *Palacios & Tirado 11287* (MO, QCNE); Lita–Carondolet Road, km 16, 800 m, *Schwerdtfeger 021422* (MO); Cantón Quinindé, NE of Las Golondrinas, Sitio La Bella Jungla, Cooperativa Unidos Venceremos, 00°20′N, 79°12′W, 300 m, *Palacios 11452* (MO); Quinindé, Bilsa Biological Reserve, Montañas de Mache, 35 km W of Santa Quinindé, 5 km W of Santa Isabela, 0°21′N, 79°44′W, 400–600 m, *Pitman & Bass 995* (MO); Fila de Bilsa, 7 km E of San José de Bilsa, 80 km due SW of Esmeraldas, 12 km SE of El Salto on Atacames–Muisne Road, 00°37′N, 79°51′W, 280 m, *Gentry et al. 72955* (MO). **Los Ríos:** Casería de Bimbo, 10.5 km N of Patricia Pilar, 0°35′N, 79°12′30″W, 550–575 m, *Croat 57000* (CM, MO); Centinela, Montañas de Ila, 13 km E of Patricia Pilar, 00°26′S, 79°30′W, 600 m, *Hammel & Trainer 15836* (MO); Centinela, 12 km E of Patricia Pilar, 650 m, *Gentry et al. 26705* (MO); El Centinela, 550–600 m, *Gentry et al. 24700* (MO).

Rhodospatha pellucida Croat & Grayum, sp. nov. TYPE: Panama. Bocas del Toro: along road between Chiriquí Grande and Fortuna, 7.7 mi. W of Chiriquí Grande, 1.5 mi. W of Punta Peña, 80 m, 8°50′N, 82°10′W, 19 Mar. 1985, *Croat & Grayum 60106* (holotype, MO-3123550; isotypes, B, K, PMA, US).

Planta epiphytica; internodia brevia, 1–2 cm diam.; petiolus 8.5–23 cm longus, vaginatus ubique; geniculum V-sulcatum; lamina oblongo-elliptica, inaequilatera, 21–41 cm longa, 7.2–14.5 cm lata; nervis primariis lateralibus 21–33 utroque.

Appressed-climbing epiphyte; stems to 2–2.5 m above ground, the flowering branches somewhat divergent; internodes shorter than broad, 1–2 cm diam. near apex (drying frequently less than 1 cm diam.) and often flattened, glossy, medium to dark green, tapered below, drying brown, matte, densely and finely granular. *Leaves* distichous, somewhat clustered toward the stem apex, spreading or ascending; petioles medium green, 8.5–23 cm long, ca. 5 mm diam. below the geniculum, sheathed throughout their length, drying matte, yellowish brown; sheath erect, persistent intact with the margin sometimes drying darker brown; geniculum C-shaped, V-sulcate adaxially, 1–1.5 cm long, somewhat shrunken on drying; blades reflexed from petiole on upper leaves, directed in line with the petioles on the lower leaves, moderately coriaceous, conspicuously bicolorous, oblong-elliptic, inequilateral, tapering ± equally toward both ends, slightly inequilateral and gradually acuminate to obtuse and abruptly acuminate at apex, acute to attenuate at base, broadest at the middle or just above the

middle, 21–41 × 7.2–14.5 cm, 2.5–4.5 times longer than wide, 1.6–3.4 times longer than petioles, dark green and glossy above, drying gray-green to olive-green or yellowish brown; matte to weakly glossy, yellow-green to silvery-green and paler below, drying yellow-brown to yellow-green; midrib paler than surface, obtusely V-sulcate above, thicker than broad and ± concolorous with surface below; primary lateral veins 21–33 pairs, somewhat to deeply impressed above, darker than surface below and convex, but drying only weakly raised to flat, 5–17 mm apart, departing from midrib at 30–47°, moderately arcuate to the margin, sometimes prominently downturned just before merging with the midrib; interprimary veins 1 alternating between adjacent primary lateral veins, much less conspicuous than the primary lateral veins; both the primary lateral and interprimary and sometimes the minor veins margined with thick black lines on drying (those of the interprimary and minor veins usually intermittent and appearing as rows of pellucid dots and streaks on living plants and appearing above as weak dark green bumps) and also with a sparse arrangement of pale raphide cells aligned with the dark black lines; minor veins 1–3 between alternate primary and interprimary veins, usually very weak, branched toward the margin; cross veins usually inconspicuous, often branched, mostly extending throughout the surface; surface minutely dark-granular, often sparsely covered with pale raphide cells on lower surface. Inflorescences 1 or 2, from the upper leaf axils; peduncles arching, (5–)12–28 cm × 6–8 mm diam., usually longer than petioles (up to 13 cm longer), sometimes equaling petioles or rarely somewhat shorter than petioles, drying light brown; spathe coriaceous, acuminate at apex and up to 1.4 cm diam. when furled, hemispherical when open, 8–15 cm long, to ca. 5 cm wide, 5–13 cm diam. when opened flat, the veins impressed, white to greenish white, matte outside, glossy and white inside, dark brown on drying, often promptly deciduous, sometimes persistent; spadix cylindroid, weakly tapered toward both ends, white to cream at anthesis, soon becoming gray or green or grayish green after anthesis, 6.3–18.5 cm long, drying 6–15 mm diam., sometimes shorter but usually 1–3 cm longer than the spathe, stipitate 4–9 mm on the back side, held at ca. 35° angle to the peduncle; flowers 4-sided, 2–2.8 mm in both directions, 12–13 visible in the principal spiral, 8–9 visible in the alternate spiral; *pistils* mostly 4-sided, sometimes irregularly 5–6-sided, 1.4–2 mm wide, the style truncate, gray, matte and minutely granular, sometimes smooth, brown; stigma broadly elliptic, slit-like, 0.9–1.1 × 0.5–0.8 mm, depressed medially, drying black with a pale ring-like base; stamens included; filaments densely embedded with short, pale raphide cells; anthers 1.2 mm long, 0.7 mm wide, the thecae oblong, connivent; pollen white. Infructescence to 15 cm long, to 2 cm diam.; seeds reniform, light brown, glossy, 0.8–1 mm long, the outer margin deeply and sharply sulcate.

Rhodospatha pellucida ranges from Nicaragua to Panama on the Atlantic slope and into Colombia and Ecuador on the Pacific slope, from sea level to 360 m in premontane moist forest and wetter parts of tropical moist forest life zones.

This species is characterized by its relatively small size, with stems less than 2 cm in diameter and leaf blades usually less than 12 cm wide. The leaf blades dry yellowish brown to yellowish green and have the primary lateral veins as well as many interprimary veins and minor veins bordered with continuous or intermittent dark black lines (appearing as irregular rows of pellucid-punctate markings on the lower surface and as minute bumps on the upper surface on fresh leaves). Also characteristic is the dark reddish granular or brownish granular lower blade surface on magnification.

Rhodospatha pellucida is perhaps most closely related to *R. killipii* Croat ined., an undescribed species restricted to the Amazon basin. These species have leaves of similar color and shape with a scattering of pale raphide cells visible on the lower surface. The latter differs in having blades that dry thicker, with minute, close ridges on the lower surface, and lacking the intermittent pellucid punctations that appear as darkened dots and dashes along the interprimary veins on the lower surface of dried leaves as found in *R. pellucida.*

Rhodospatha pellucida is also similar to *R. forgetii* N. E. Brown, a species apparently also from Costa Rica. *Rhodospatha forgetii* differs in having thicker blades that are not at all dark granular-punctate on the lower surface, and have more prominently raised primary lateral veins without the dark margins or the intermittent dark dots and streaks along the interprimary veins and the minor veins.

Paratypes. COLOMBIA. **Chocó:** km 185, 14 km E of Tutunendo, 5°44′N, 76°43′W, *Croat 56285* (CHOCO, JAUM, MO); near Río Iró, ca. 10 km S of Istmina, 5°14′30″N, 76°41′00″W, 50 m, *Croat 57389* (MO). **Nariño:** Tumaco, Corr. Llorente, Vereda el Carmen, *Díaz et al. 1104* (COL). COSTA RICA. **Alajuela:** 300 m, Ciudad Quesada to Los Chiles, 9 km N of Ciudad Quesada, Río Peje, 10°22′N, 84°28′W, *Hammel et al. 15306* (CR, MO); San Carlos, 3 km S of Boca de Arenal, Río San Carlos,

Hacienda Boca Arenal, 100 m, 10°30′N, 84°30′W, *Hammel & de Nevers 15325* (MO); 22 km NE of Quesada by air, 4 km W of Muelle San Carlos, 10°28′N, 84°30′W, *Liesner 14139* (MO), *Liesner 14157* (MO); 2 km N of Santa Rosa, 15 km N of Boca Arenal on Quesada–Muelle San Carlos–Los Chiles road, 100 m, 10°38′N, 84°31′W, *Liesner et al. 15033* (CR, MO); 15 km WNW of Quesada by air, 1 km W of Jabillos, 150–200 m, 10°23′N, 84°33′W, *Liesner et al. 15149* (MO); along road from Cañas to Upala, 13.8 km N of Bijagua, 100–150 m, *Croat 36426* (MO); new Volcán Arenal, *Taylor & Taylor 11609* (MO). **Guanacaste:** Lake Arenal, from Río Chiquito to Río Caño Negro, 10°27′N, 84°50′W, 550–850 m, *Hammel et al. 15155* (MO). **Heredia:** La Selva Reserve, at confluence of Río Sarapiquí and Río Puerto Viejo, 10°26′N, 84°01′W, 50–100 m, *Grayum 7668* (MO), *Hammel 9517* (MO), *Croat 78734* (INB, MO), *Grayum & Sleeper 2896* (DUKE, MO); Puerto Viejo, 50 m, *Burger & Stolze 5836* (CR, F, US), *Croat 35713* (MO). **Limón:** in Tropical wet forest, and Premontane wet forest, Cordillera de Talamanca along Río Barbilla, from jct. with Río Dantas to ca. 1 km downstream, 10°01′N, 83°25′W, 100 m, *Grayum et al. 8966* (MO); between Quebrada Mata de Limón & Quebrada Tigre, Finca Anai, (Sixaola region), 09°34′N, 82°40′W, 25–30 m, *Grayum et al. 4450* (CR, MO); trail from Mata de Limón to Finca Anai, 09°33′N, 82°38′W, 15 m, *Grayum & Schatz 5260* (CR, MO); Río Frío to Limón, vic. Río Blanco, W of Guápiles, Quebrada Danta, 3 mi. S of main highway along old railroad bed, 10°12′N, 83°49′W, 360 m, *Croat 68424* (MO); Ref. Nac. Barra del Colorado, 10–15 m, *Grayum 9845* (CR, MO); hills 2 airline km SSE of Islas Buena Vista in the Río Colorado, 14 airline km SW of Barra del Colorado, 10°40′N 83°40′W, 10–20 m, *Davidse & Herrera 31091* (MO); Cerro Coronel, E of Laguna Danto, 10°41′N, 83°38′W, elev. 20–170 m, *Stevens 24558* (MO); Hacienda Tapezco, *Davidson & Donahue 8499* (LAM), *Davidson & Donahue 8759* (LAM), *Davidson & Donahue 8979* (LAM, MO). ECUADOR. **Esmeraldas:** 8.6 km beyond bridge over Río Esmeraldas (near San Mateo, on road to Esmeraldas airport), ca. 6.6 km beyond Universidad Tecnológica Luis Vargas Torres-Estación Experimental Mútile, along Río Mútile (tributary of Río Esmeraldas), 0°52′N, 79°33′W, 80 m, *Croat 55628* (QCA, MO); Esmeraldas–Muisne, 50 km SW of Atacames, *Balslev & Steere 3104* (QCA). NICARAGUA. **Rio San Juan:** La Lupe, ca. 25 km ENE of Boca de Sábalo, *Salick & Stijfhoorn 8269-b* (MO). PANAMA. **Bocas del Toro:** Fortuna–Chiriquí Grande, on side road 10 mi. from continental divide, on trail off pipeline trace, 8°55′N, 82°10′W, 300 m, *McPherson 12566* (MO, PMA); Fowler hill above RR station at Milla 7.5, *Croat 16402* (MO). **Colón:** Sabanitas–Portobello, Río Piedras Lumber Road, departing main highway 6.7 mi. E of Sabanitas, 3.9 mi. up logging road in direction of Santa Rita Ridge, 09°22′30″N, 79°41′30″W, 250 m, *Croat 75156* (CM, K, MO). **San Blas:** El Llano–Cartí road, Km 26.5, 9°19′N, 78°55′W, 200 m, *de Nevers et al. 7846* (MO).

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Five New Taxa and Two New Combinations of Acanthaceae from Central America

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ABSTRACT. Five new taxa from Central America, *Anisacanthus nicaraguensis* (compound dichasial cymes, 4-merous red corollas, 3-colporate pollen), *Aphelandra scabra* var. *angustifolia* (narrowly elliptic leaves), *Justicia cauliflora* (some inflorescences on old wood, lanceolate bracts, greenish white corolla), *J. chiriquiensis* (cymose panicles, oblanceolate bracts, 4-porate pollen), and *J. nicaraguensis* (clusters of 2–3 flowers to short spikes, corollas orange, dicolporate pollen), are described. The new combination *Justicia rothschuhii* (Lindau) Durkee, based on *Chaetothylax rothschuhii* Lindau, is made, and the new name *Justicia danielii* Durkee, which replaces *Chaetothylax cuspidatus* D. N. Gibson, is provided.

In preparation of the family treatment of Acanthaceae for the *Flora de Nicaragua* and *Flora Mesoamericana*, examination of recent collections has revealed four new species and one new variety. In each case these taxa were collected from areas that have not been well collected in the past. Also, as the result of combining *Chaetothylax* with *Justicia* (Graham, 1988), two Central American species of the former genus must now be transferred to the latter.

Anisacanthus nicaraguensis Durkee, sp. nov. TYPE: Nicaragua. Departamento Estelí: "Kukamonga," 18.5 m N of Estelí, 13°14′N, 86°21′W, elev. ca. 850 m, 19 Jan. 1985, *Pedro P. Moreno 25325* (holotype, MO; isotype, CAS). Figures 1, 6A.

Frutex ad 3 m. Folia ovata, 27–75 mm longa, 9–25 mm lata, apice acuminato, basi acuta ad obtusa; petiolis ad 27 mm. Inflorescentiae spiciformes secundae vel cymae compositae sine floribus basibus; bracteae lineares-subulatae, 3.5–4.5 mm longae. Corollae rubrae, 4-merae, 33–35 mm longae. Fructus clavati, 15–17 mm longi, glabri, seminibus 4.

Shrub to 3 m tall. Young stem quadrate-fluted, glabrous except for puberulence at the nodes; older stems subquadrate or terete, brown epidermis shredding in long strips. Leaves ovate, blades 27–75 mm long, 9–25 mm broad, apically acuminate, basally acute to obtuse, margins entire to crenulate, glabrous, cystoliths to ca. 0.2 mm long, abundant and plainly visible on both surfaces of dried leaves; petioles to 27 mm long, glabrate. Inflorescences basically compound dichasial cymes lacking the central or basal flower, to 2.5 cm long, inflorescence branches sometimes appearing as secund spikes, rachises minutely puberulent with hairs ca. 0.1 mm long plus occasional, slightly longer glandular hairs; bracts and bracteoles linear-subulate, 3.5–4.5 mm long, 0.3–0.4 mm broad at base, sparingly puberulent. Flowers with short pedicels 0.5–1.5 mm long; calyx 5-merous, 11–15 mm long, segments equal, deeply divided, long subulate, 9–13 mm long, glandular-puberulent; corollas red, 4-merous, 33–35 mm long, puberulent outside, upper lip single-lobed, 29 mm long, 0.8–0.9 mm broad, lower lip 3-lobed, lobes 15–17 mm long, 2.5–3 mm broad, apically acute; stamens 2, exserted, filaments to 33 mm long, attached near base of corolla, glabrous, anthers bithecous, thecae parallel, equal, 3.6–3.8 mm long, pollen prolate, 50–55.3 × 27.2–29 μm, 3-colporate, pseudocolpi on either side of each pore, insulae lacking; style to 42 mm long, extending beyond stamens, stigma bilobed. Fruit a clavate capsule, 15–17 mm long, 5.8–6.9 mm broad, glabrous, tuberculate, stipe 6–8 mm long; seeds 4, 5.8–6.5 mm long, 4.4–5.1 mm broad, glabrous, margins conspicuously thickened.

Habitat, distribution, and phenology. *Anisacanthus nicaraguensis* is known only from the type collected in flower and fruit in January. The collection area, Cuesta de Kukamonga, is a mesa that has been collected repeatedly in recent years, leading W. D. Stevens of MO to conclude that the plant is rare in this generally arid area that, he told me, has resulted from an old basaltic lava flow now eroded into a series of mesas, flat-topped hills, or mountains with steep slopes. The soil that overlies the basalt is thin and black. He also related that the area has a distinctive vegetation dominated by *Agave*, columnar cacti, thorny shrubs, and small trees, with occasional oaks where the soil is a little deep-

Figure 1. A–E, *Anisacanthus nicaraguensis* Durkee (*Moreno 25325*). —A, B. Habit. —C. Fruit. —D. Corolla. —E. Enlarged view of inflorescence.

er, and numerous epiphytes. The "Cuesta" is where the Pan American Highway ascends the first mesa going north from Estelí.

Etymology. The species epithet refers to the country in which the type collection was made.

According to Daniel (1982), *Anisacanthus* is a genus of ca. 16 species of perennial shrubs with a center of distribution in mostly dry habitats of Mexico. Its closest relative is presumably the genus *Carlowrightia,* which grows in similar habitats, but its species are typically shorter plants with 5-merous corollas (vs. 4-merous) that lack the bright red or orange color characterizing species of *Anisacanthus.* This is the first known collection of the genus *Anisacanthus* in Nicaragua. *Anisacanthus nicaraguensis* most closely resembles *A. tetracaulis* Leonard of Honduras, but differs from this species in its longer corollas (33–35 mm vs. 20–23 mm), longer

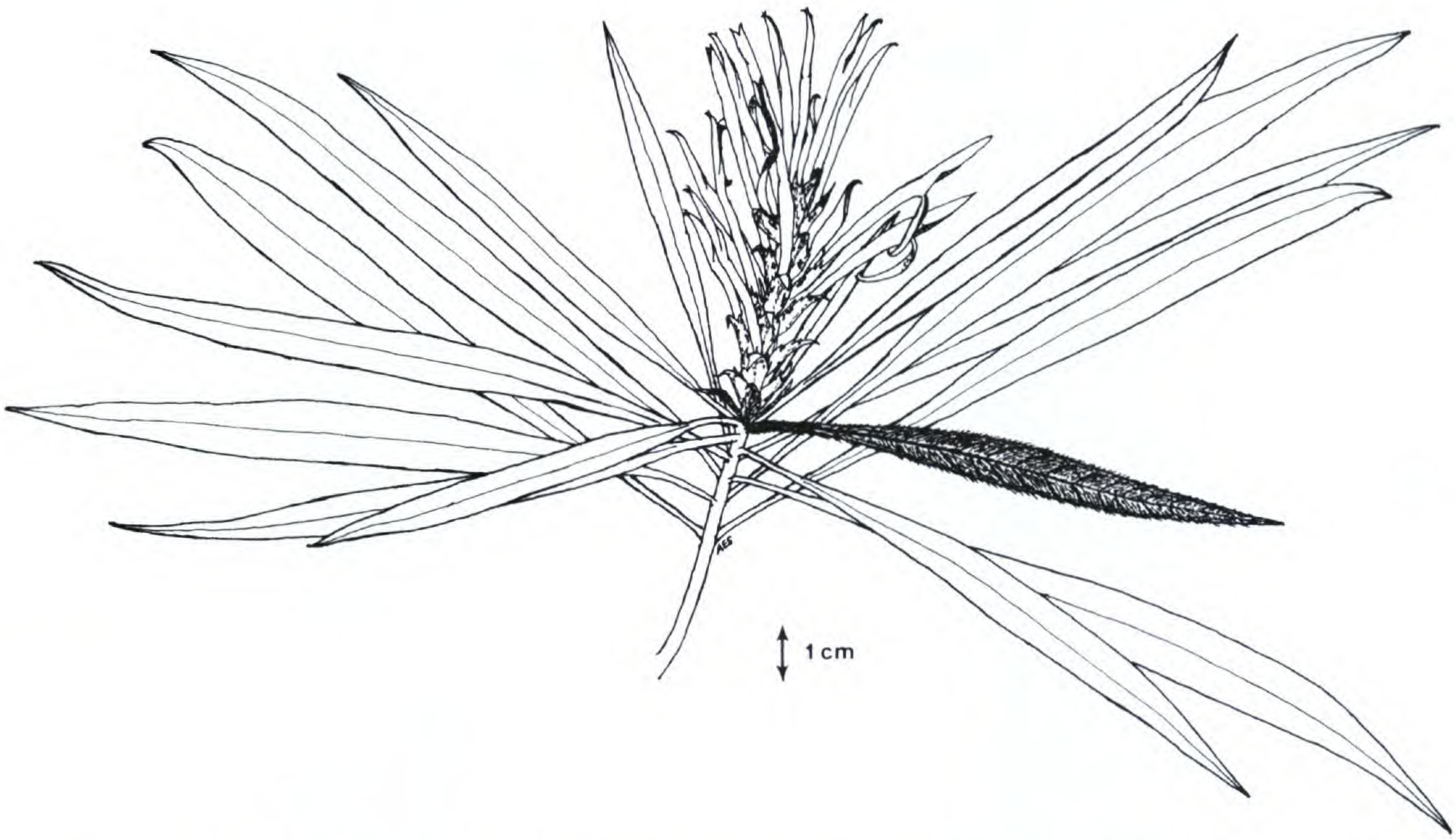

Figure 2. *Aphelandra scabra* (Vahl) Smith var. *angustifolia* Durkee (*Herrera, Morris & Mojica 1061*, MO). —Habit.

sepals (9–13 mm vs. 5–7 mm), longer bracts and bracteoles (3.5–4.5 mm vs. 1–3 mm), and longer thecae (3.6–3.8 mm vs. 2.9–3.0 mm). The other species of the genus are from Mexico north of Chiapas, the adjacent United States, and South America. No other species of the genus have been described from Central America.

Aphelandra scabra (Vahl) Smith var. **angustifolia** Durkee, var. nov. TYPE: Panama. San Blas: on solid ground at Playón Chico, Río Grande (Ukupseni), between Neba Dummat and camp Kariadi, 09°15′N, 78°15′W, elev. 50–100 m, 2 Nov. 1991, *H. Herrera, J. Morris & J. Mojica 1061* (holotype, MO; isotypes, CAS, PMA). Figure 2.

Folia anguste elliptica, 6.7–15.5 cm longa, 0.6–1.3 cm lata; corollae 4.3–4.6 cm longae.

This variety differs from the type variety (which ranges from Mexico to Brazil) by its leaves, which are narrowly elliptic, 6.7–15.5 cm long, 0.6–1.3 cm broad, glabrous above, with appressed hairs beneath that are more dense on the costa; by its puberulous petioles, 2–10 mm long; and by its corolla that is 4.3–4.6 cm long (slightly longer than that of the type variety) and glabrous outside.

Habitat, distribution, and phenology. This variety is described as "common to the edge of the river" in the vicinity of the type locality and "along the creek" in the other area of collection. No other information is given. These collections were made at lower altitudes, 50–150 m, of the Caribbean coastal region and Pacific watershed area of Panama. These are apparently similar habitats although separated by the Cordillera de San Blas. Additional collection would probably reveal a more extensive range for the variety.

Etymology. The varietal epithet refers to the conspicuously narrow leaves.

Paratype. PANAMA. **Panamá:** along El Llano–Cartí road, along creek E of road, 9°15′N, 79°00′W, 150 m, 8 Sep. 1989, *G. McPherson 14036* (MO).

Justicia cauliflora Durkee, sp. nov. TYPE: Panama. Panamá: 5–10 km NE of Altos de Pacora, ca. 750 m, 7 Mar. 1975, *S. Mori & J. Kallunki 4961* (holotype, MO). Figures 3, 6B.

Suffrutex ad 2 m. Folia elliptica, 4.5–20 cm longa, 1.4–6.3 cm lata, apice acuminato, basi attenuata; petiolis 4–20 mm longis. Inflorescentiae spiciformes, terminales et axillares, ad 5 cm longae; bracteae lanceolatae, 14–15 mm longae, 3–4 mm latae. Corollae labiae superae viridi-albae, labiae inferae lavandulaceae. Fructus clavati, 20–22 mm longi, seminibus 4.

Suffrutescent herb to 2 m tall. Young stem quadrangular, strigose. Leaves elliptic, 4.5–20 cm long, 1.4–6.3 cm broad, apically acuminate, basally attenuate, margins crenate, glabrous above, puberulent along costa and main veins beneath, cystoliths visible on both surfaces; petioles 4–20 mm long, strigose. Inflorescences in what appear as terminal

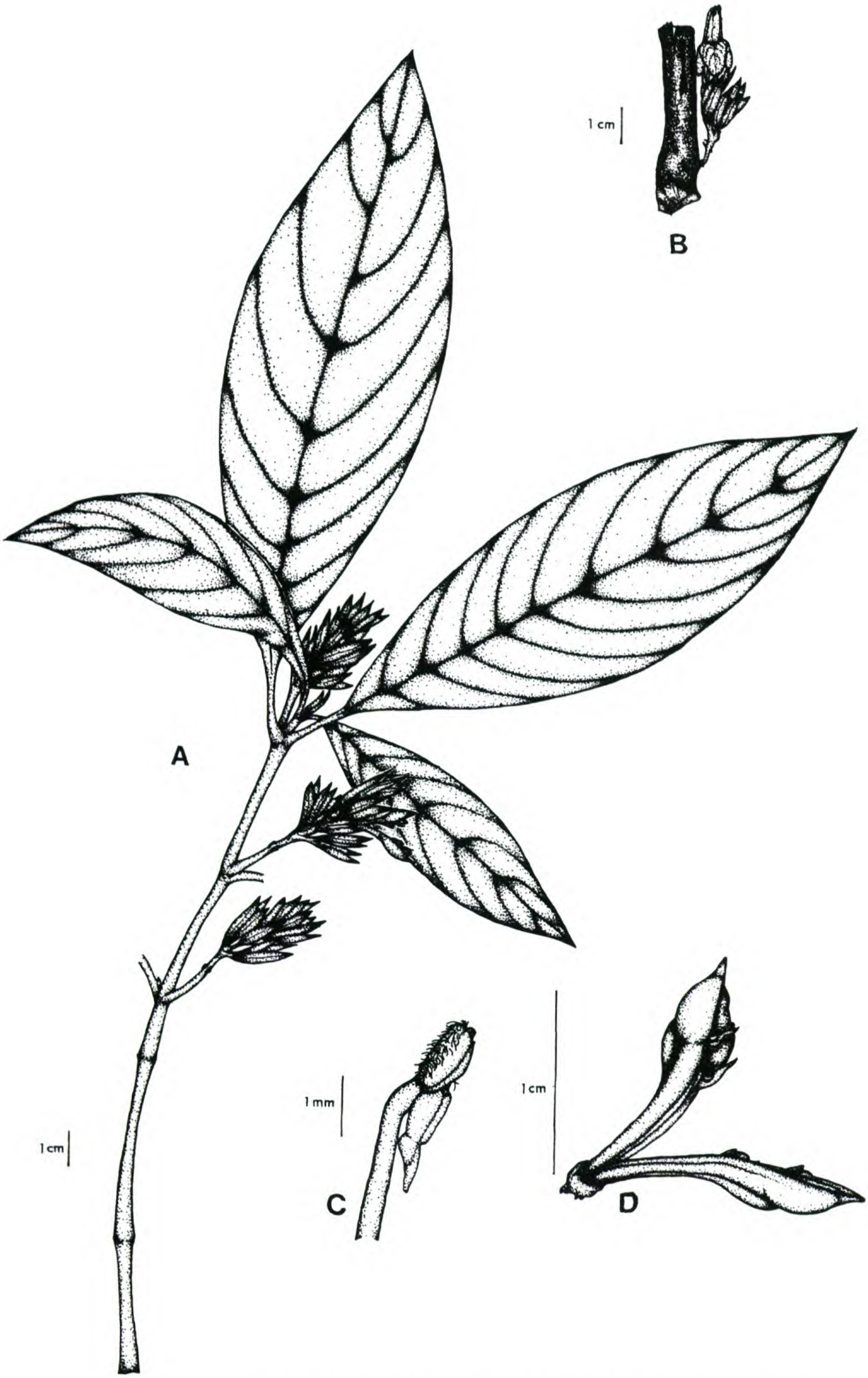

Figure 3. *Justicia cauliflora* Durkee (*Mori & Kallunki 4961*). —A. Habit. —B. Inflorescence on older, woody stem. —C. Anther with detail of appendage on lower theca. —D. Capsule.

and axillary spikes to 5 cm long, 1.5 cm broad, some occurring on old wood as well, bracts lanceolate, 14–15 mm long, 3–4 mm broad, puberulent, mostly opposite but occasionally subopposite, each bract with one flower most often, but occasionally with two flowers per bract, suggesting that the inflorescence is thyrsoid with dichasia usually reduced to one flower; bracteoles narrowly lanceolate, 13–13.5 mm long, 1.7–2 mm broad, puberulent; peduncle to 18 mm long, strigose. Flowers 5-merous, calyx segments equal, narrowly lanceolate, 12–15 mm long, 1.7–2 mm broad, puberulent; corolla bilabiate, 2.7–2.8 cm long, glandular-puberulent, tube ca. 1.6 cm long, upper lip emarginate, greenish white, ca. 13 mm long, 6 mm broad, lower lip 3-lobed, lavender, ca. 12 mm long, 12 mm broad, lobes rounded, ca. 3 mm long, 4 mm broad; stamens two, exserted to the tip of the upper lip, filaments attached just below the apex of the corolla tube, ca. 11 mm long, glabrous, thecae superposed, upper theca 1.5–1.8 mm long, lower theca with basal appendage, 1.7–1.9 mm long excluding appendage, appendage 0.6–1.0 mm long, pollen prolate, 49–57.2 × 31–40.3 μm, 2-colporate, one row of insulae on each side of the pore, ca. 8 insulae per row, fitting Graham's (1988) Type 5 pollen most closely. Capsule clavate, 20–22 mm long, 6 mm broad, 5 mm thick, puberulent, seeds 4, suborbicular, ca. 4 mm diam.

Habitat, distribution, and phenology. Found in premontane rainforest.

Justicia cauliflora is recognized by its spicate inflorescences (some occurring on old wood) with lanceolate bracts, 14–15 mm long, greenish white corolla ca. 2.8 cm long that has a lavender lower lip and a glandular-puberulent indumentum, stamens with superposed thecae but only the lower cell with a basal appendage, and filaments that are attached at the apex of the corolla tube. It appears to have some affinity to *J. fortunensis* T. F. Daniel & Wasshausen of Panama but differs from it in bract shape (lanceolate vs. broadly elliptic to subcirculate to obovate), length of calyx lobes (12–15 mm vs. 4.5–6.5 mm) and length of corolla (27–28 mm vs. 8–10 mm). It also resembles *J. veraguensis* T. F. Daniel & Wasshausen of Panama, which has obovate to broadly elliptic bracts, shorter calyx lobes (5–6 mm), and a shorter corolla 10–13 mm long.

Justicia cauliflora is found in open areas of premontane rainforest near Altos de Pacora of the Province of Panamá and along streams in lower altitude forest on the Atlantic slope of Veraguas Province.

Paratype. PANAMA. **Veraguas:** Atlantic slope, Río Concepción to Río Barrera, ca. 100 m, 16 Oct. 1978, *Hammel 5180* (MO).

Justicia chiriquiensis Durkee, sp. nov. TYPE: Panama. Chiriquí: Fortuna Dam, along Quebrada Arena, S of continental divide, 08°45′N, 82°15′W, 1050 m alt., 8 Sep. 1987, *G. McPherson 11699* (holotype, MO). Figures 4, 6C.

Suffrutex ad 1.5 m. Folia elliptica ad elliptico-ovata, 10–15 cm longa, 3–8 cm lata, apice acuminato, basi acuta ad obtusa; petiolis 0.5–3 cm longis. Inflorescentiae thyrsiformes, terminales, ad 14 cm longitudine; bracteae oblanceolatae, 4.5–6.5 mm longae, 0.7–1.3 mm latae. Corollae albae, 16–18 mm longae, staminibus exsertis. Fructus non observatus.

Suffrutescent herb to 1.5 m tall. Stem quadrangular, puberulent in younger portions. Leaves elliptic to elliptic-ovate, 10–15 cm long, 3–8 cm broad, apically acuminate, basally acute to obtuse, margins crenulate to entire, glabrous above, puberulent on costa below, cystoliths abundant and prominent on both surfaces of dried specimens; petioles 0.5–3 cm long, puberulent. Inflorescences in loose terminal cymose panicles (thyrses) ca. 14 cm long, 8 cm broad, rachises puberulent; bracts oblanceolate, 4.5–6.5 mm long, 0.7–1.3 mm broad, with short, glandular trichomes plus longer eglandular trichomes; bracteoles similar but slightly smaller. Flowers 5-merous, calyx segments equal, lanceolate, 5–6 mm long, 1–1.3 mm broad, pubescence that of the bracts and bracteoles; corolla white, puberulent outside, bilabiate, 16–18 mm long, the tube 7–9 mm long, basally ca. 4.5 mm broad, the upper lip erect, keeled, apically emarginate, lower lip with pale purple markings, 3-lobed, the lobes apically rounded, each ca. 2 mm long, 3 mm broad; stamens two, exserted to about the tip of the upper lip, thecae superposed, ca. 3 mm long, basally spurred, pollen subprolate, 56.7–66.7 × 43.8–48.3 μm, 4-porate, trema not differentiated, whole surface microreticulate, studded with rows of smooth, obtuse verrucae, rows separated at each trema area, somewhat resembling Type 9 pollen as described by Graham (1988) except that the verrucae are obtuse instead of conical. Fruit not observed.

Habitat, distribution, and phenology. Known only from the type collection, this species was in flower in September and was collected along a stream in rainforest in the vicinity of Fortuna Dam.

Etymology. The specific epithet refers to the province in which the type was collected.

Among Mesoamerican *Justicia*, *J. chiriquiensis* is recognized by its crenulate leaves, inflorescences in cymose panicles, oblanceolate bracts 4.5–6.5 mm long, 4-porate pollen, and white corolla 16–18

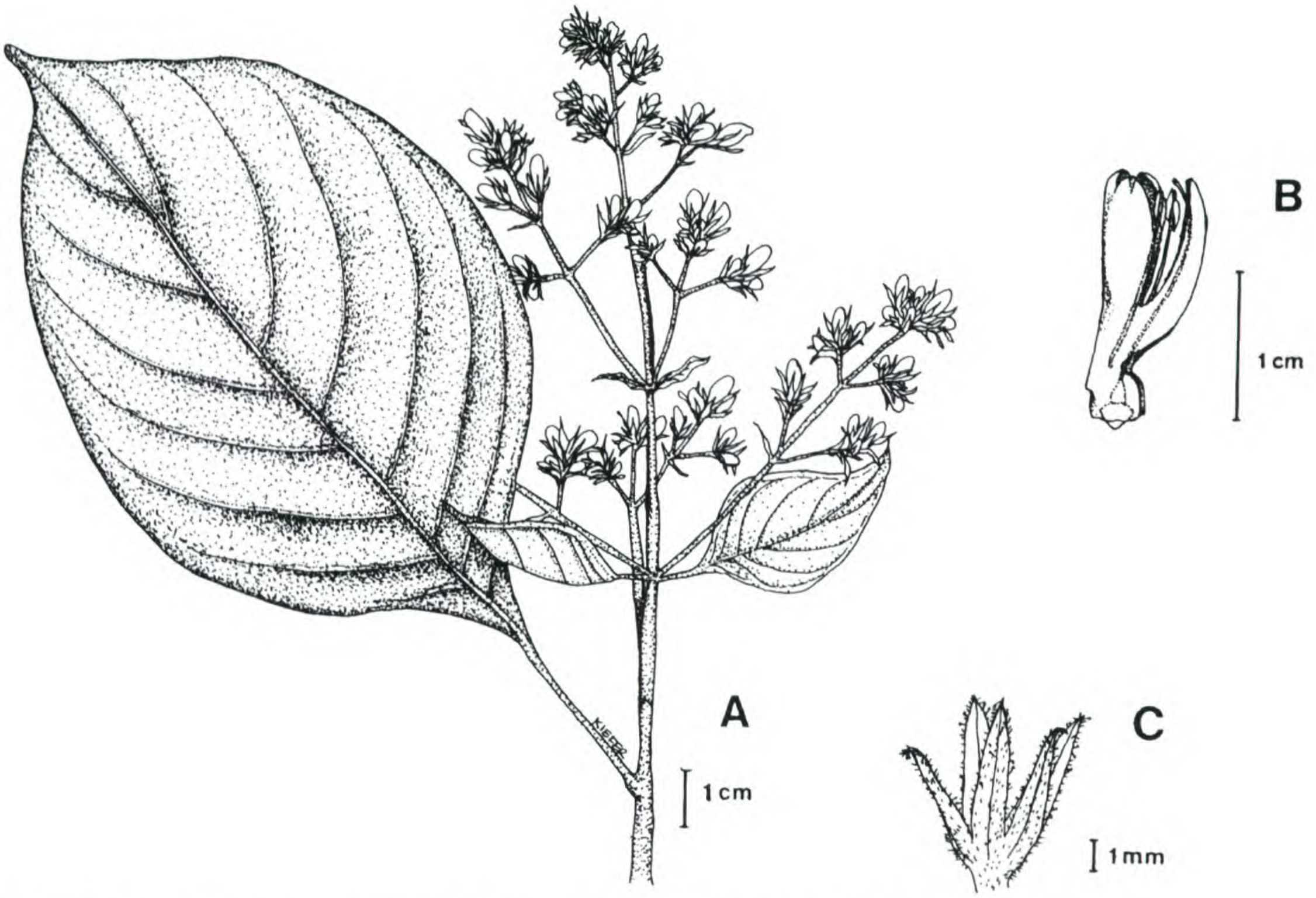

Figure 4. *Justicia chiriquiensis* Durkee (*McPherson 11699*). —A. Habit. —B. Corolla. —C. Calyx.

mm long. It bears some resemblance to *J. crenata* (Leonard) Durkee but can be distinguished by its crenulate leaves (vs. crenate), cymose panicles (vs. spicate), oblanceolate bracts (vs. elliptic), and white corolla 16–18 mm long (vs. red with yellow-tipped corolla to 50 mm long). It can be distinguished from *J. pectoralis* Jacquin by its elliptic to elliptic-ovate leaves (vs. lanceolate), cymose panicles (vs. spicate), oblanceolate bracts 4.5–6.5 mm long (vs. subulate bracts ca. 2 mm long), calyx 5–6 mm long (vs. 2 mm long), and corolla 16–18 mm long (vs. 8–12 mm).

Justicia danielii Durkee, nom. nov. Replaced name: *Chaetothylax cuspidatus* D. N. Gibson, Fieldiana Bot. 34: 58. 1972. Not *Justicia cuspidata* Vahl, 1790. TYPE: Guatemala. Alta Verapaz: valley of Santa Lucía, on road from Gualán to Cobán, 650 m, *Pittier 1792* (holotype, F).

This species has also been collected in Honduras.

Justicia nicaraguensis Durkee, sp. nov. TYPE: Nicaragua. Zelaya: along trail from Cerro Saslaya to San José del Hormiguero, between Caño Majagua and Caño Sucio, tall evergreen forest, ca. 13°45′N, 84°59′–85°00′W, 600–800 m, 10 Mar. 1978, *W. D. Stevens 6848* (holotype, MO; isotype, CAS). Figures 5, 6D.

Caulis ligneus, volubilis vel frutex ad 4 m. Folia ovata ad lanceolata, 3.8–10.2 cm longa, 1–3.7 cm lata, apice acuminato, basi obtusa ad rotundata; petiolis ad 5 mm. Inflorescentiae in fasciculae parvae vel spicas ad 15 mm longas; bracteae longi-subulatae, 9–11 mm longae, glandulari-pubescentes; corollae aurantiacae. Fructus clavati, curvi, 33 mm longi, seminibus 4.

Liana or shrub to 4 m tall. Young stem subterete with unilineately retrorse yellow pubescence. Leaves ovate to lanceolate, blades 3.8–10.2 cm long, 1–3.7 cm broad, apically long acuminate, basally obtuse to rounded, margins entire to undulate, sparingly pilose mostly on costa on both surfaces, cystoliths abundant and easily seen in dried leaves above, less visible beneath; petioles to 5 mm long, puberulent. Inflorescences ranging from terminal and axillary clusters of 2–3 flowers to short, compact spikes to 15 mm long, peduncles 9–14 mm long with appressed-pilose trichomes; bracts and bracteoles long-subulate,

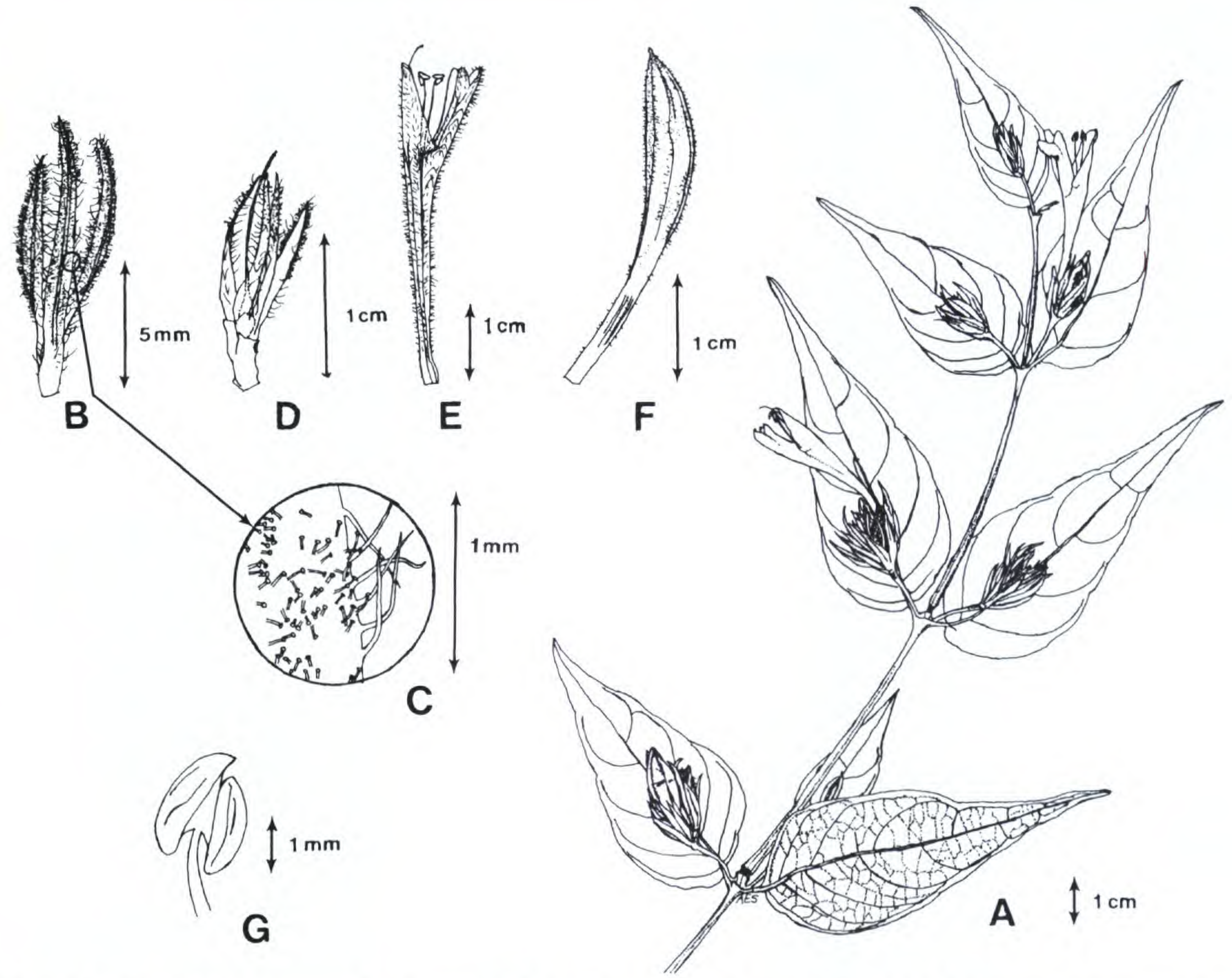

Figure 5. *Justicia nicaraguensis* Durkee. —A. Habit. —B. Bract and bracteoles. —C. Enlargement of bract surface trichomes. —D. Calyx. —E. Corolla. —F. Capsule. —G. Anther thecae. (A from *Pipoly 6289*; B–G from *Stevens 6848*.)

bracts 9–11 mm long, bracteoles 8–8.5 mm long, both densely glandular-puberulent externally. Flowers opposite or alternate, one per bract, sessile to subsessile; calyx 7.5–12 mm long, 4-merous, segments equal, long-subulate, 6.5–10 mm long, with external eglandular puberulence plus smaller glandular hairs; corollas orange, bilabiate, 35–41 mm long, externally pubescent with trichomes 0.3–0.6 mm long, upper lip apically acute, not divided, 10–11 mm long, lower lip 3-lobed, 10–13 mm long, 4–

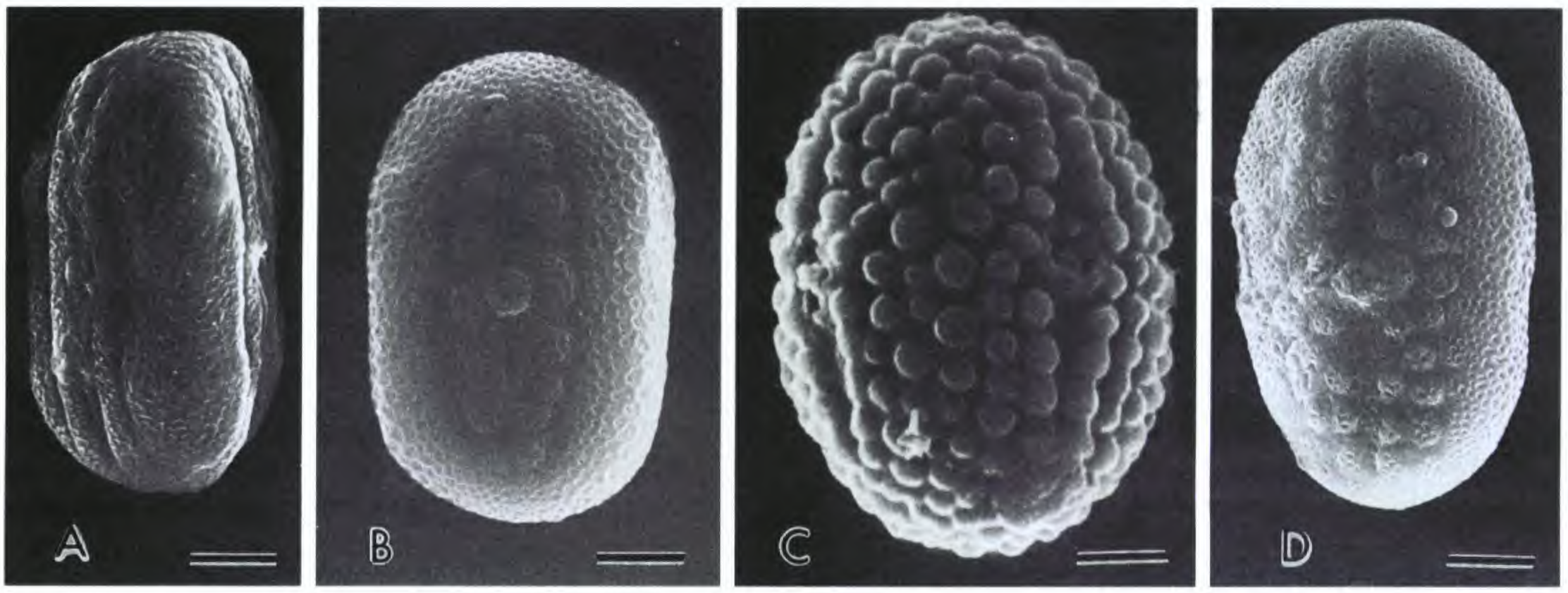

Figure 6. Scanning electron micrographs of pollen. —A. *Anisacanthus nicaraguensis* (*Moreno 25325*). —B. *Justicia cauliflora* (*Hammel 5180*). —C. *Justicia chiriquiensis* (*McPherson 11699*). —D. *Justicia nicaraguensis* (*Pipoly 6289*). Scale lines represent 10 μm.

4.5 mm broad, lobes apically rounded, 3–4 mm long, middle lobe 2.2–2.5 mm broad, lateral lobes 1.7–2.2 mm broad; stamens attached at the base of the upper lip, filaments 8.5–9.5 mm long, thecae unequally attached at a subperpendicular angle, upper theca 2.2 mm long, lower theca 1.5 mm long, both lacking basal appendages, pollen prolate, 52–54.4 × 32.5–35.5 μm, dicolporate, 4 rows of insulae in each trema region, most closely resembling Graham's (1988) Type 7 pollen; style 32–35 mm long, glabrous. Capsule clavate, curved, 33 mm long, 4 mm broad, seed-bearing area elliptic, not constricted, gradually tapering into a stipe 18 mm long, minutely glandular-puberulent; seeds 4, mature seeds not observed.

Habitat, distribution, and phenology. The three collections of *Justicia nicaraguensis* observed for this description were found along a trail in tall evergreen forest and at a finca in disturbed secondary forest, the species thus appearing to occur in both primary and secondary forest areas. All collections were from the same general area of Zelaya Department, Nicaragua, and were collected in March, each displaying flowers and fruits. Elevation 300–800 m.

Etymology. The species epithet refers to the country in which the original collection was made.

Among Nicaraguan *Justicia*, *J. nicaraguensis* is recognized by its shrubby and/or scandent viny habit and ovate leaves with long acuminate apices and obtuse to rounded bases; short petioles to 5 mm long; inflorescences of axillary headlike clusters of 2–3 flowers or short, compact spikes to 15 mm long; 4-merous calyx; orange corollas 35–41 mm long; and curved, gradually tapered capsule that is 33 mm long. It is not easily confused with other *Justicia* species from Nicaragua, but it shares some characters with *J. sulfurea* (Donnell Smith) D. N. Gibson of Guatemala in its leaf size and shape, its inflorescences of headlike clusters, and its calyx that is 4-merous and of similar length, but differs in its viny habit, its orange corollas that are longer (35–41 mm vs. 20–28 mm), and corolla lips that are about one-half the length of the corolla tube (vs. about equal). *Justicia nicaraguensis* also resembles *J. madrensis* T. F. Daniel, an endemic from Chiapas, Mexico, in its 4-merous calyx, color and length of corolla, leaf shape and size, and inflorescence type, but differs in its viny habit, longer bracts (9–11 mm vs. 1.8–2.5 mm), inflorescence length (15 mm vs. 55 mm), longer calyx (7.5–12 mm vs. 5.5–9 mm), and length and shape of capsule (33 mm vs. 20 mm, elliptic head with no constrictions vs. elliptic head with medial constriction).

None of the species of *Justicia* from Costa Rica that do not also occur in Nicaragua are likely to be confused with *Justicia nicaraguensis.*

Paratypes. NICARAGUA. **Zelaya:** along same trail as holotype, in tall secondary growth evergreen forest, ca. 13°45′N, 84°58–59′W, elev. 300–450 m, *Stevens 7015* (MO); Finca S of La Pimienta, ca. 13°45′N, 84°59′W, *Pipoly 6289* (CAL, MO).

Justicia rothschuhii (Lindau) Durkee, comb. nov.
Basionym: *Chaetothylax rothschuhii* Lindau, Bull. Herb. Boissier 3: 492. 1895. TYPE: Nicaragua. Matagalpa: on a river bank near Mazmaz, 200 m, 22 Mar. 1894, *Rothschuh 410* (holotype, B destroyed; photo at F); Nicaragua. Chontales: ca. 2.8 km N of Cuapa, disturbed evergreen forest on hillside, 12°17′N, 85°23′W, 400–500 m, *W. D. Stevens 6143* (neotype, MO; isoneotype, CAS).

This species has also been collected in Guatemala, Honduras, and Costa Rica.

Acknowledgments. I thank the curator of MO for providing the specimens for examination, and Laura Goddard, Gretel Kiefer, Allison Shaw, and Kristin Stuchis for the illustrations. I also thank Allison Shaw and Lenore Durkee who made the scanning electron micrographs.

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A New Species of *Corallorhiza* (Orchidaceae) from West Virginia, U.S.A.

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ABSTRACT. *Corallorhiza bentleyi* Freudenstein is described from West Virginia, U.S.A. The species is cleistogamous and is currently known from only one population. It is most similar to *C. striata* Lindley, specifically variety *involuta* (Greenman) Freudenstein from southern Mexico, particularly in the structure of the labellum and size of the flower.

Corallorhiza Gagnebin comprises 11 species (including the one herein) of temperate-montane leafless orchids (Freudenstein, 1997). The genus is limited to the New World, except for *C. trifida* Chatelain, which is circumboreal. The centers of diversity are southern Mexico and the northeastern United States and Canada. The present taxon is currently known from only a single population but should be sought elsewhere in the region; given its cleistogamous nature, plants could be dismissed easily as individuals of the much more common *C. maculata* (Rafinesque) Rafinesque in bud.

Corallorhiza bentleyi Freudenstein, sp. nov. TYPE: U.S.A. West Virginia: Monroe Co., ca. 43 km NW of Roanoke, Virginia, 18 July 1998, *Freudenstein 2550* (holotype, AMES). Figure 1.

Species *Corallorhizae striatae* var. *involutae* (Greenman) Freudenstein maxime similis, sed callo ampliore labelli et floribus cleistogamis differt.

Plants to ca. 20 cm tall, reddish to yellow, with up to 20 flowers. Leaves reduced to sheaths. Rhizomes coralloid, roots absent. Flowers closed, perianth connivent, perianth segments 3-veined, those other than the labellum with very faint darker reddish striping, sometimes with yellowish perianth and reddish ovary and rachis. Dorsal sepal lanceolate, 5.9–6.1 mm long, 2.1–2.5 mm wide. Lateral sepals lanceolate, somewhat falcate, strongly cymbiform, 5.5–6.1 mm long, 2.1–2.5 mm wide. Lateral petals narrowly ovate, weakly cymbiform, acute, 5.0–5.8 mm long, 2.2–3.0 mm wide. Labellum unlobed, ovate, acute, with prominent, thickened, involute margin, 4.9–5.7 mm long, 3.1–3.5 mm wide and with slightly upturned apex; callus formed from two fused lamellae at the base of labellum, ca. 1/2 as long as the labellum, 2.5–2.8 mm long, 1.5–1.8 mm wide. Column curved forward, 3.0–3.8 mm long, 0.8–1.0 mm wide, with a small depression adaxially at its base. Rostellum triangular. Pedicellate ovary narrowly obovoid, 6.0–9.0 mm long, 2.5–3.0 mm diam., without adaxial mentum at summit.

Etymology. The species is named for Stanley Bentley, of southwestern Virginia, who discovered and first recognized the distinctness of this population.

This unusual *Corallorhiza* is known from a single population in an area ca. 4 m × 4 m on an abandoned revegetated railroad grade, with neither tracks nor ties present, in Appalachian deciduous forest of *Acer pensylvanicum* L., *Liriodendron tulipifera* L., *Quercus*, and *Rhododendron*. The population has increased in number since it was discovered in 1996. Four plants in fruit were noted that year, with eight stems in 1997, 20 in 1998, and 27 in 1999 (S. Bentley, pers. comm.). Although individuals of *Corallorhiza* are often clonal, the variation in color seen in this population suggests that more than one clone is present. Searches in the immediate area have not yet uncovered additional individuals. Neither were specimens detected in a monographic study of the genus (Freudenstein, 1997) or in a recent search of material at WVA. However, it seems likely that other individuals may exist, since the site was an active railroad earlier in the 20th century, and the plant could almost certainly not have been growing at its present location at that time.

The species is clearly most similar to *Corallorhiza striata* Lindley, which is the only other species to have an unlobed labellum with involute margins, fused lamellae at the base of the labellum, and the absence of a small spur (often called a "mentum") at the summit of the ovary. *Corallorhiza striata* is a morphologically variable species that has a wide distribution across North America. The population of *C. striata* nearest to the West Virginia

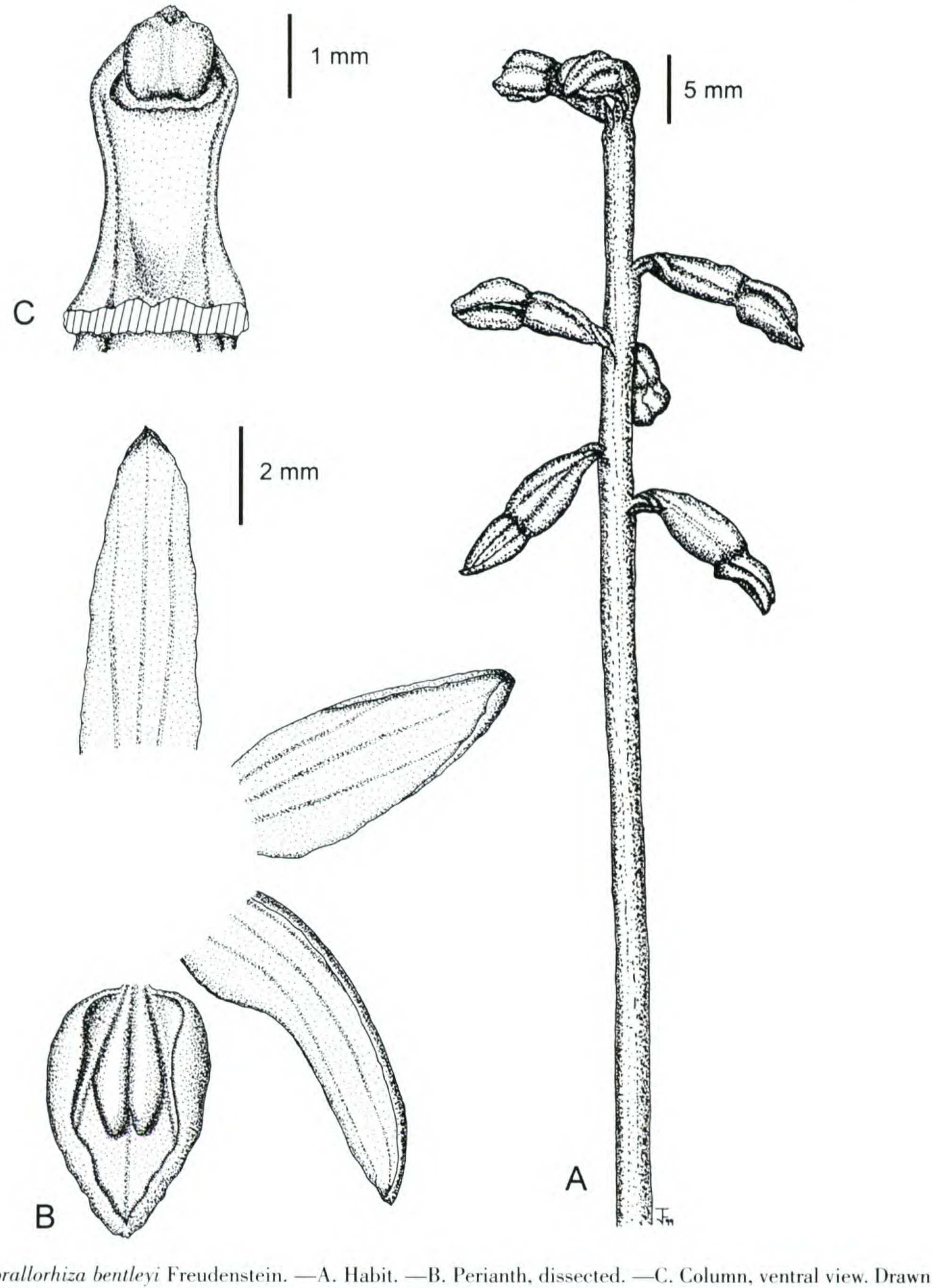

Figure 1. *Corallorhiza bentleyi* Freudenstein. —A. Habit. —B. Perianth, dissected. —C. Column, ventral view. Drawn by the author from a photograph and spirit material collected at the type locality.

locality is in central New York, where the species is very rare. However, the flowers of *C. bentleyi* differ strikingly in size from northern North American *C. striata*, being only one-half to one-third their size. Remarkably, *Corallorhiza bentleyi* is most similar to the small Mexican forms of *C. striata* that have been called *C. involuta* Greenman, but were most recently recognized as *C. striata* var. *involuta* (Greenman) Freudenstein (Freudenstein, 1997) because of the essentially continuous cline of decreasing flower size from northeastern North America southwestward to southern Mexico. The taxa differ in the proportions of the fused lamellae at the labellum base, being ca. half the length of the labellum in *C. bentleyi* and ca. one-quarter the length in *C. striata* var. *involuta*.

Corallorhiza bentleyi and northern *C. striata* also differ in flowering phenology. *Corallorhiza striata* is

an early-flowering species; in northern Michigan, where the plant can be locally frequent, it is typically in flower during the first week in June. *Corallorhiza bentleyi* flowers much later, during mid to late July. In montane regions of Mexico, *C. striata* var. *involuta* is also in flower during mid to late July.

The other clear difference between *C. bentleyi* and *C. striata* var. *involuta* is that the flowers in the former are cleistogamous. *Corallorhiza striata* varies in the degree to which the perianth expands, with the northeastern plants often having widely expanded flowers that are at least sometimes insect-pollinated (Freudenstein, 1997), while flowers of southwestern and Mexican populations tend to be less widely opened, but no truly cleistogamous flowers have been reported previously in this species. Many instances are known of species in which both chasmogamous and cleistogamous flowers are produced on the same plant, including *Viola* spp. (Russell, 1965), *Ajuga iva* (L.) Schreber (Ruiz De Clavijo, 1997), *Lamium amplexicaule* L., and *Impatiens pallida* Nuttall (Stewart, 1994; see Uphof, 1938, and Lord, 1981, for reviews). Perhaps less common are species with two types of individuals, each producing only cleistogamous or chasmogamous flowers. These have sometimes been given taxonomic standing (Uphof, 1938). Among orchids, a peloric cleistogamous form is known from Mexico in *Corallorhiza odontorhiza* (Willdenow) Poiret as variety *pringlei* (Greenman) Freudenstein forma *radia* Freudenstein, and a more widespread, primarily cleistogamous variety is also known in that species (var. *odontorhiza*; Catling, 1983; Freudenstein, 1997). Some populations of *Nervilia gassneri* B. Pettersson are cleistogamous (Pettersson, 1989, 1990). A number of instances of wholly cleistogamous species are also known ("complete cleistogamy" of Uphof, 1938). Recently described species from Orchidaceae include *Cheirostylis notialis* D. L. Jones, a cleistogamous or nearly cleistogamous species (Jones, 1997), and *Epipactis futakii* Mered'a & Potucek (Mered'a & Potucek, 1998).

Although cleistogamy is rare, autogamy is known in many temperate orchid species and is accomplished in different ways (Catling, 1983). The flowers of most *Corallorhiza* have a distinct pollinium stalk derived from the rostellum (a hamulus; Freudenstein, 1994). In *C. striata* the hamulus is well developed and functions in insect pollination. Cleistogamous forms of *C. odontorhiza* have essentially no hamulus (Catling, 1983; Freudenstein, 1994). *Corallorhiza bentleyi* does have a hamulus, but since the flowers do not open it is not utilized; the pollinia germinate in situ and grow down to the stigma on either side of the rostellum.

The cleistogamous nature of *C. bentleyi* could be a clue as to its origin. Two possibilities exist: either it was dispersed by chance from Mexico to West Virginia, or it is a relictual population of a taxon with a formerly more extensive distribution. The chances of an orchid seed being transported this distance and finding the appropriate fungus with which to interact seem remote. Since there are no currently known cleistogamous populations of *C. striata* in Mexico, the evolution of cleistogamy would probably have occurred after dispersal, arguing against a recent dispersal. The relict hypothesis seems more likely, since it is easier to conceive of a formerly more extensive distribution that has contracted with changing environmental and perhaps pollinator conditions. The absence of a pollinator would have favored any tendencies toward autogamy and cleistogamy, and it is perhaps simply fortuitous that the current population has survived.

Acknowledgments. I am grateful to Stan Bentley for bringing this population to my attention, to John B. Nelson and Lawrence Magrath for comments on the manuscript, and to Donna Ford-Werntz for assistance at WVA. This research was supported by NSF grant DEB-9615437.

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A New Species of *Miconia* Ruiz & Pavón (Melastomataceae) from Espírito Santo, Brazil

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ABSTRACT. *Miconia capixaba* belongs to *Miconia* sect. *Miconia*, series *Paniculares* Naudin. It is distinguished from related species by the dense, stellate trichomes on young branches, inflorescences, and hypanthia, as well as abaxial leaf surfaces, and by cuneate leaf bases, small panicles, triangular inner calyx lobes, and a papillose (otherwise glabrous) ovary apex. This species occurs in montane forests in the state of Espírito Santo, Brazil, a flora noted for other endemic taxa within Melastomataceae.

Miconia capixaba R. Goldenberg, sp. nov. TYPE: Brazil. Espírito Santo: "Município de Santa Teresa, Estação Biológica de Santa Lúcia, árvore não amostrada, próximo à parcela 63," 21 July 1993 (fl), *L. D. Thomaz s.n.* (holotype, MBML 9300; isotypes, CEPEC, K, MO, UEC). Figure 1A–F.

Haec species congeneris sect. *Miconiae* ser. *Paniculariium* Naudin ramis, lamina foliari subtus, inflorescentia hypanthioque dense stellato-puberulis, lamina foliari basi cuneata modice decurrenti, paniculis parvis laxis, calycis laciniis internis triangularibus, ovario ad apicem papilloso distinguitur.

Tree 4–16 m tall, young branches slightly compressed, older branches terete, internodes 1.4–3 cm long, along with inflorescences, hypanthium, and petioles densely covered with stellate, yellowish brown to ferrugineous trichomes ca. 0.1 mm diam. Blades 6.5–12 × 1.4–3.1 cm, lanceolate, apex acuminate, base cuneate and shortly (1–2 mm) decurrent, entire to repand on the upper half, chartaceous, lamina adaxially stellate-furfuraceous, soon glabrous, lustrous and dark olive-green, abaxially also densely stellate pubescent, white, but nerves yellowish brown, shortly 3-plinerved, with a faint pair of inframarginal nerves, secondary veins free, diverging 1–2 mm from the base; primary, secondary, and transverse veins impressed above, but primary and secondary veins prominent below and with transverse ones faint, reticulation barely visible above and below, the areoles 0.7–1 mm diam. Petioles 5–10 mm long, canaliculate, slightly sulcate. Panicles 1–2.5 × 0.9–1 cm, terminal, pyramidate or elongate, depauperate, with 2 branchlets per node; bracteoles ca. 0.6 mm long, narrowly deltoid to linear, persistent; flowers sessile (laterals in each dichasium on short, ca. 1 mm, peduncles), 5-merous. Hypanthium ca. 1.6 mm long, campanulate, without longitudinal ridges; calyx tube 0.2–0.3 mm long, caducous, inner lobes ca. 0.6 mm long, triangular, acute; outer lobes inconspicuous. Petals 1.7 × 1 mm, papillose, margins papillose-ciliate, obovate to oblong, apex deeply emarginate, with 2 irregular lobes 0.3 mm long. Stamens 10, in two series, white, only slightly heteromorphic, the larger ones with filaments 1.9–2.1 mm long, anthers 1.7–1.8 mm long, linear-oblong, arcuate, thecae 1.3–1.4 mm long; the smaller ones with filaments 1.5–1.9 mm, anthers 1.4–1.5 mm, linear-oblong, straight, thecae ca. 1.1 mm; anthers of both cycles with a narrow apical pore, ca. 0.1 mm diam.; connective prolonged 0.3–0.4 mm below the thecae, dorsally thickened and not appendaged, ventrally with two minute lobes, sometimes directed backward and appearing like dorsal appendages. Ovary 0.7–0.9 mm high, fused to the hypanthium for ½ of its length, 3-celled, with 2–3 ovules in each cell, apex rounded, obscurely 5-lobed, papillose; style 4.5–5 mm long, filiform, apex truncate, not thickened. Mature fruits not seen.

Miconia capixaba is morphologically similar to species in the section *Miconia* ser. *Paniculares* Naudin and section *Glossocentrum* Bentham & Hooker. The morphology of its anthers indicates relationship to the former (connective ventrally bilobed vs. dorsally calcarate or unappendaged). Within *Miconia* ser. *Paniculares*, *Miconia weddellii* Naudin has glomerulate inflorescences (Wurdack, 1974) and leaves densely villose below. *Miconia burchellii* Triana and *M. pohliana* Cogniaux differ from *M. capibaxa* in many vegetative characters (leaves broader, 5–7-nerved, with rounded to cordate bases). *Miconia irwinii* has less dense pubescence and rounded, wider calyx lobes. *Miconia cipoensis* R. Goldenberg ined. (in press) has similar inflorescences and flowers, but shorter and wider

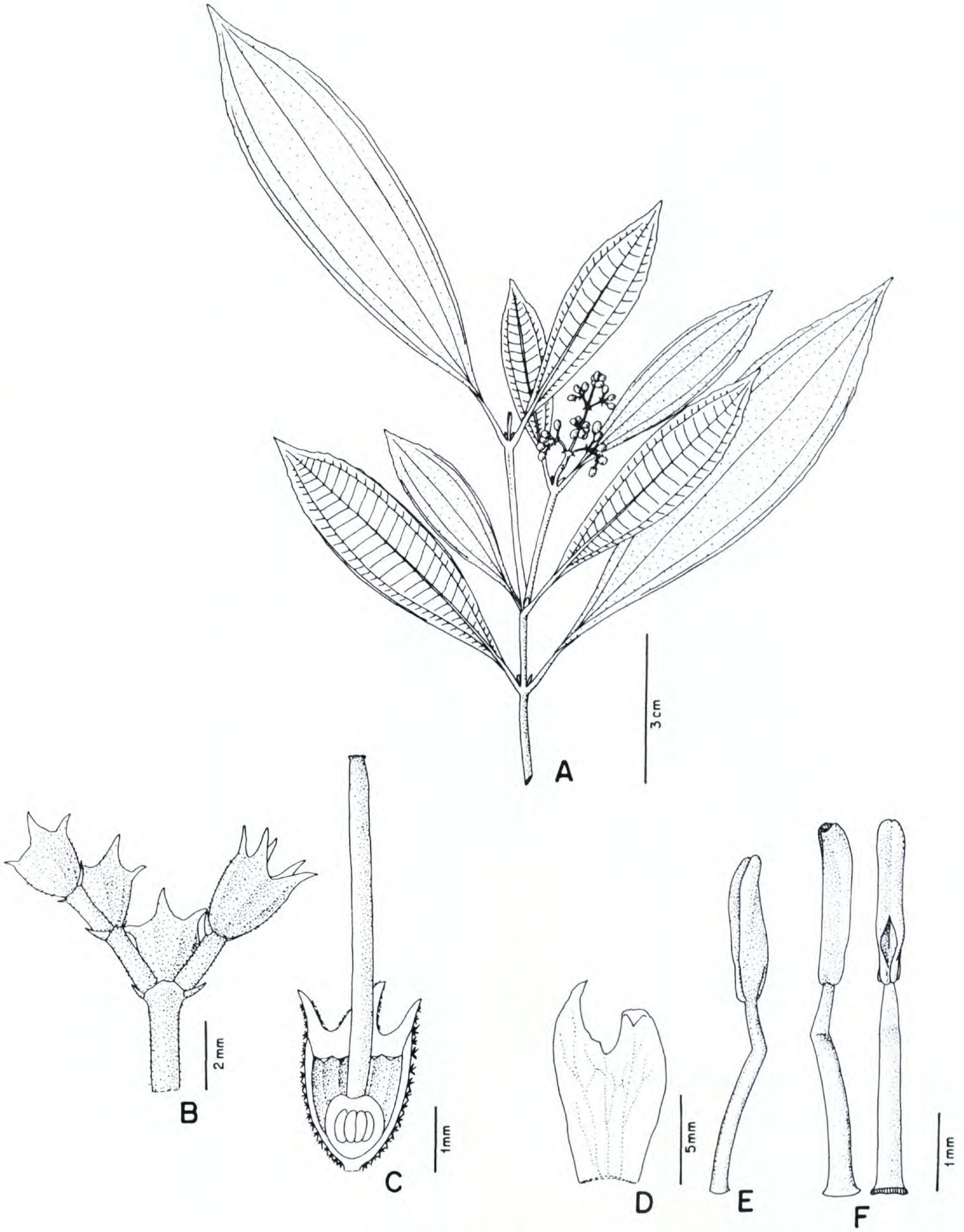

Figure 1. *Miconia capixaba* R. Goldenberg (all drawings from *L. D. Thomaz 819*). —A. Branchlet with an inflorescence. —B. Inflorescence unit showing the external appearance of the hypanthium and calyx. —C. Longitudinal section of hypanthium and ovary. —D. Petal. —E. Smaller stamen, frontal-lateral view. —F. Larger stamen, dorsal and frontal view.

leaves with dendritic trichomes and a stellate ovary apex.

Within *Miconia* sect. *Glossocentrum*, *M. capixaba* is vegetatively similar to *M. cubatanensis*, which has stamens with a single dorsal appendage and a completely inferior ovary with its apex covered by stellate trichomes. *Miconia brasiliensis* (Sprengel) Triana and *M. pauciflora* Cogniaux also have quite similar flowers, but with unappendaged or dorsally calcarate stamens and leaves with more sparsely distributed trichomes. *Miconia setosociliata* Cogniaux has ciliate leaf margins (often not evident in some collections from Espírito Santo, e.g., *W. Boone 446*, US), clubbed dendritic hairs on the branchlets, and blades with the nerves basally fused by a membrane. Finally, *M. pepericarpa* DC. has 4-merous flowers and dendritic trichomes on the lower leaf surface.

Miconia capixaba occurs in the mountains of the state of Espírito Santo, along the Brazilian coast between Bahia and Rio de Janeiro. These mountains have a particularly rich flora (Thomaz & Monteiro, 1997), with several endemic melastomes, such as *Dolichoura espiritusanctensis* Brade, *Meriania tetramera* Wurdack, *Merianthera burlemarxii* Wurdack, and *Leandra fallacissima* Markgraf. The melastome flora of Espírito Santo also includes some poorly known species, otherwise collected only in adjacent Rio de Janeiro (*Miconia longicaudata* Cogniaux, *M. octopetala* Cogniaux, *M. setosociliata* Cogniaux) or Bahia (*Meriania callophylla* (Naudin) Triana).

The epithet "capixaba" is derived from the Brazilian word for people or things native to the state of Espírito Santo.

Paratypes. BRAZIL. **Espírito Santo:** "Município de Santa Teresa, Estação Biológica de Santa Lúcia," 20 Aug. 1996 (fl), *R. Goldenberg et al. 375* (MBML, UEC, US); "Estação Biológica de Santa Lúcia, mata atlântica de encosta, beira do rio, 650–800m," 30 Aug. 1994 (fl), *L. D. Thomaz 819* (HRCB, UEC); "Estação Biológica de Santa Lúcia, planta nº 1543," 21 July 1993 (fl), *L. D. Thomaz 848* (MBML, VIES).

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A New *Calyptranthes* (Myrtaceae) from Nicaragua

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ABSTRACT. In preparation for the treatment of *Calyptranthes* (Myrtaceae) for the *Flora de Nicaragua*, a summary and identification key to the five known species from the country are presented. One of these, *Calyptranthes amarulenta* B. Holst, a new species from central Nicaragua, is described and illustrated. The new species is characterized by having bicolorous leaf blades when dry that are rounded to obtuse at the apex, a biconvex midvein on the upper leaf surface, and a glabrous inflorescence.

The known Nicaraguan *Calyptranthes* flora includes five species. Three of these are widespread: *C. chytraculia* (L.) Swartz from mostly lowland, coastal regions in southern Mexico and the Greater Antilles to northern Colombia, *C. hylobates* Standley ex Amshoff from lowland, mostly evergreen forests in Mexico, Costa Rica, and Panama, and *C. pallens* Grisebach, a polymorphic species found from low to moderately high elevations in semideciduous forests of southern Florida, Mexico, Central America, and the West Indies. The fourth species, *C. amarulenta* B. Holst, is endemic to semideciduous forests at low elevations in central Nicaragua, and the fifth, a species of uncertain status, is known from mid-elevation cloud forests in Honduras and Nicaragua. The following key distinguishes the Nicaraguan species.

KEY TO THE SPECIES OF *CALYPTRANTHES* IN NICARAGUA

1a. Branches of the inflorescence and/or flowers densely pubescent.
  2a. Inflorescence tomentose . . . . . *C. chytraculia*
  2b. Inflorescence sericeous . . . . . *C. pallens* var. *williamsii*
1b. Branches of the inflorescence and flowers glabrous, or at most with a few sparse hairs.
  3a. Young stems narrowly winged or 4-angled; peduncles and pedicels filiform . . *C. hylobates*
  3b. Young stems terete or compressed, never angled; peduncles and pedicels robust.
    4a. Leaf apices rounded to obtuse; midvein biconvex on upper leaf surface . . . . . *C. amarulenta*
    4b. Leaf apices abruptly long-acuminate; midvein sulcate on upper leaf surface . . . . . *C.* sp.

Calyptranthes amarulenta B. Holst, sp. nov. TYPE: Nicaragua. Chontales: Hacienda Veracruz, including Cerro La Batea and Cerro Los Charcos, 120–475 m, 12°11′N, 85°21′W, 17 July 1983, *W. D. Stevens 22252* (holotype, MO; isotypes, BM, CR, EAP, F, HNMN, JBSD, K, MEXU, NY, SEL, SP, U, US). Figure 1.

Frutex vel arbor usque ad 8 m altus, ramulis compressis. Folia petiolo 4–6 mm longo sicco nigro, lamina in sicco bicolori, elliptica vel obovata, obtusa vel rotundata, costa supra biconvexa, venis lateralibus obscuris vel submanifestis. Panicula 8 ad 13 flora. Flos glaber; calyptra apiculata, hypanthio 1–2 mm longo. Fructus glaber, globosus.

Shrub 2–3 m tall or tree to 8 m tall; twigs slightly compressed, glabrescent, the young vegetative parts with sparse, scurfy trichomes. Leaves short-petiolate, the petioles 4–6 mm long, black when dry, shallowly sulcate; blades bicolorous when dry, the upper surface dull to slightly lustrous, olive- to gray-green, lower surface brownish green, broadly elliptic to obovate, 5.2–7.2 × 2.5–4.2 cm, chartaceous, glabrescent; midvein broad, biconvex; secondary veins scarcely evident, 10 to 13 on each side; marginal vein 1–2 mm from blade margin and parallel to it, as prominent as the secondaries; apex obtuse to rounded; margin plane to slightly revolute; base cuneate; glands barely impressed-punctate on upper surface, convex or plane on lower surface. Inflorescence glabrous, twice branched, solitary or paired on abortive axes; bracts caducous, not known; peduncle 3.2–4.5 cm long; secondary branches 3–4.5 cm long. Flowers 8 to 13 per panicle, glabrous, sessile or seemingly long-pedicellate on 1-flowered branches that are 8–10 mm long; bracteoles caducous, not known; petals, stamens, style, and stigma unknown; hypanthium prolonged 1–2 mm beyond the ovary; calyptra apiculate, 3 mm wide. Fruits glabrous, globose, ca. 1 cm diam.; seed 1.

Calyptranthes amarulenta is known from the departments of Chontales and Matagalpa in Nicaragua where it is locally common in primary or disturbed, semideciduous forests at 120–500 m elevation. It is known by the common name "coralillo." The spe-

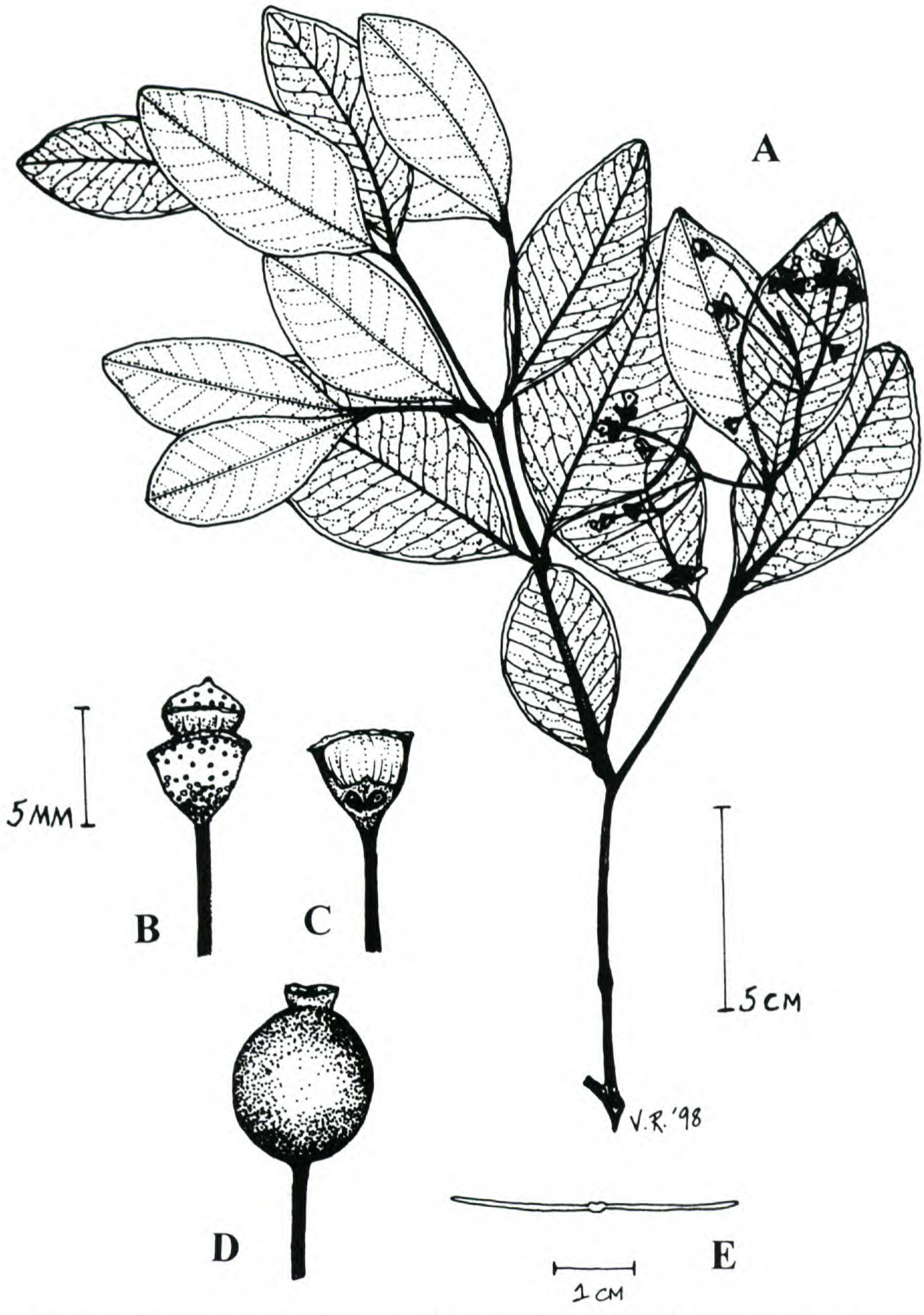

Figure 1. *Calyptranthes amarulenta* B. Holst. —A. Habit (leaf venation slightly exaggerated to show detail). —B. Flower, past anthesis. —C. Transverse section of flower. —D. Fruit. —E. Cross section of leaf blade. Drawn from *Stevens 22428* (fruit); *22252* (habit, flowers, leaf detail).

cific epithet denotes the fruits, which are described as very bitter and inedible (*Stevens 22428*).

Calyptranthes amarulenta is readily distinguished from all other *Calyptranthes* in Nicaragua by having blunt leaves that dry bicolorous and a broad, biconvex midvein. It appears to be most closely related to *C. millspaughii* Urban of southern Mexico and Belize, from which it differs by having glabrescent (vs. densely appressed-pubescent with coppery hairs) inflorescences and flowers and obtuse to rounded (vs. abruptly acuminate) leaf apices.

Paratypes. NICARAGUA. **Chontales:** ca. 2.8 km above (N of) Cuapa, ca. 12°17′N, 85°23′W, 400–500 m, 4 Sep. 1977, *W. D. Stevens 3700* (MO); Hacienda Veracruz, including Cerro La Batea and Cerro Los [Charcos],

120–475 m, 12°11′N, 85°21′W, 4–6 Aug. 1983, *W. D. Stevens 22428* (MO, SEL). **Matagalpa:** Ranchería, 11 km al NE de Muy muy, aprox. 280 m, 12°46′N, 85°31′W, 20–22 Aug. 1984, *P. P. Moreno 24440* (MO, SEL), *24441* (MO).

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A New Species of *Roucheria* and a New Species of *Hebepetalum* (Hugoniaceae) from the Venezuelan Guayana

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ABSTRACT. A new species of *Roucheria* and a new species of *Hebepetalum* (Hugoniaceae) from southern Venezuela are described and illustrated. *Roucheria sipapoensis* is a montane, small-leaved shrub known only from Cerro Sipapo in Amazonas state, while *Hebepetalum neblinae* is a lowland, wet forest tree from white sand areas in southernmost Venezuela and northern Brazil. Keys to the species of both genera are provided.

Roucheria and *Hebepetalum* are closely related woody taxa in the Linales. Cronquist (1988) placed both genera in the Hugoniaceae, although they had earlier been treated in a more broadly circumscribed Linaceae (Planchon, 1847; Bentham, 1862). While preparing the Hugoniaceae treatment for the *Flora of the Venezuelan Guayana* (Ramírez et al., 1999) and undertaking a revisionary study of *Hebepetalum* and *Roucheria*, we discovered one new species in each genus. Venezuela is the center of diversity of these genera, with five species of *Roucheria* and all three species of *Hebepetalum* occurring there. The species commonly known as *Roucheria punctata* (Ducke) Ducke is now considered a synonym of an earlier name, *R. columbiana* Hallier (Ramírez et al., 1999).

Cronquist's circumscription of Hugoniaceae is supported here based on results of revisionary work of these genera, which point to the presence of drupaceous fruit, woody habit, and crenulate/subcrenulate leaf margins with glands as supporting shared characters with the family. *Hebepetalum* is distinguished from *Roucheria* by its petals with a clawed base which are inwardly pubescent, the presence of trichomes of variable density at the apex of the ovary, and broquiodromous leaf venation with secondaries joined in a series of conspicuous and well-formed arches. In *Roucheria* the venation is camptodromous, with the secondary veins tightly parallel, and lacking the series of conspicuous arches. Both genera share a submarginal collecting (fimbrial) vein, which is formed by the fusion of the secondaries. The leaf venation in *Roucheria* is reminiscent of that of many members of the Clusiaceae and Ochnaceae. Including the species described below, we now recognize eight species in *Roucheria* and three in *Hebepetalum*.

Roucheria sipapoensis Jardim & P. E. Berry, sp. nov. TYPE: Venezuela. Amazonas: Cerro Sipapo, Paraque, higher plateau, among rocks, 1798 m, 12 Dec. 1948, *B. Maguire 27625* (holotype, MO; isotypes, NY, WIS). Figure 1.

Haec species inter congeneros vegetative glabros *Roucheriae monsalveae* A. H. Gentry foliis subsessilibus decurrentibus etiam *R. elatae* Ducke inflorescentia ex panicula axillari 1–4 cm longa constante maxime accedit, sed a hac foliis valde coriaceis atque habitu humiliore altitudine 10 m non excedente, ab illa foliis plerumque minoribus in sicco griseo-olivaceis atque inflorescentia paniculata, ab ambabus lamina foliari marginibus ad basim valde revoluta distinguitur.

Shrub or *small tree* 3–10 m tall; stems glabrous, nodes round. *Leaves* alternate, simple, ovate-elliptical, coriaceous, subsessile, olive-gray upon drying, with a thin layer of wax, 1.8–8.5 cm long, 0.5–2.5 cm wide, broadly acute at the apex, decurrent, with inrolled margins at the base, glabrous, dark green on the adaxial surface, light green abaxially; midvein raised abaxially, impressed adaxially, numerous strongly parallel secondary veins terminating at the margin in a submarginal, continuous collecting vein, raised on both surfaces; margins crenate-subserrate with numerous dentations, 40–55 glands per leaf, inconspicuous, oval, present in each sinus between dentations and flush, not raised in sinus; petioles 0–4 mm long; stipules triangular, caducous, 0.7–0.9 mm long. *Inflorescence* axillary panicles grouped toward the branch apices, axis 1–4 cm long, canaliculate. Flowers regularly arranged on branches of inflorescence, each branch 1- to several-flowered; bracteoles obovate, 1–1.5 mm

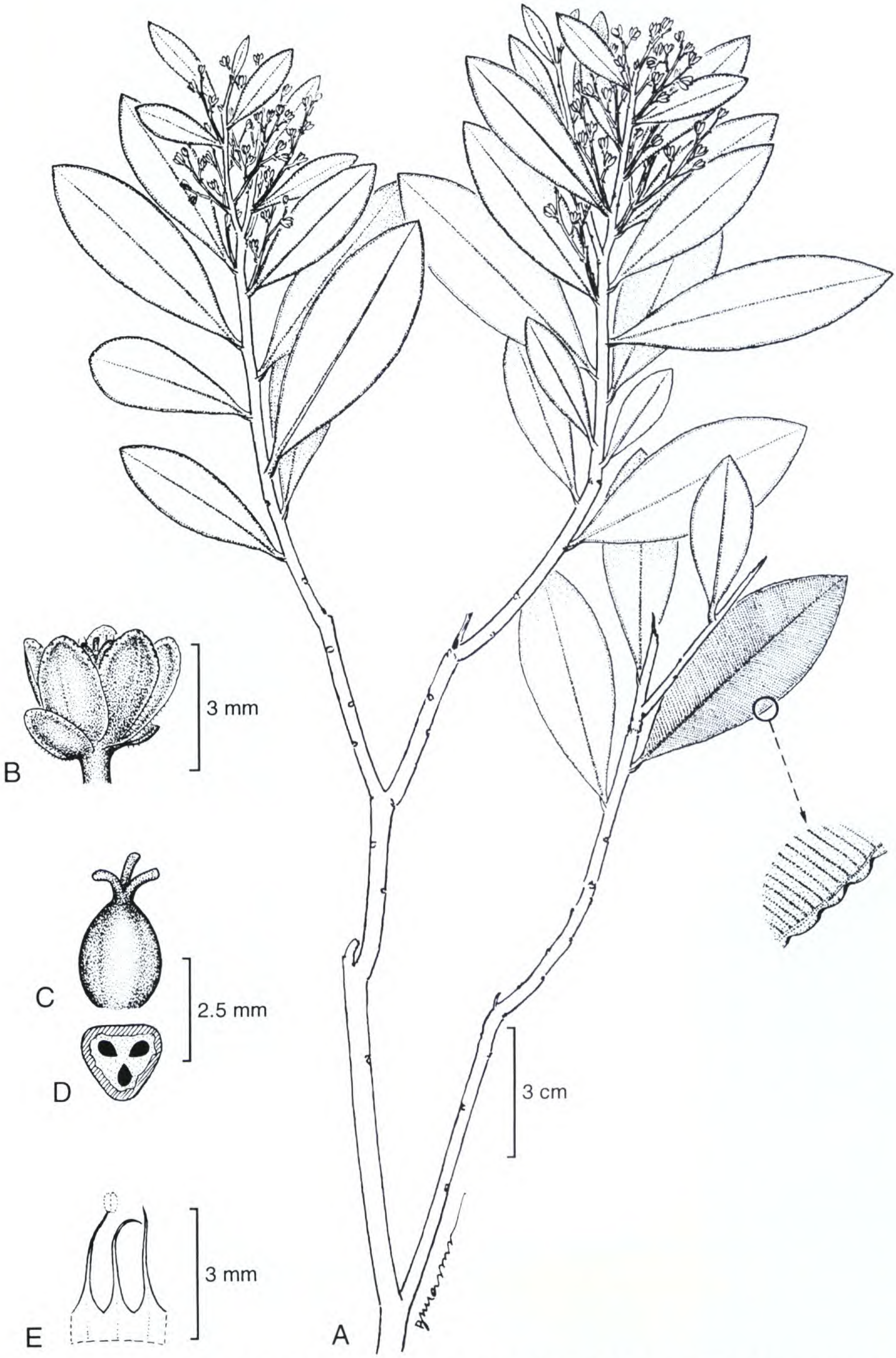

Figure 1. *Roucheria sipapoensis* Jardim & P. E. Berry. —A. Habit and detail of leaf margin. —B. Flower slightly past anthesis. —C. Ovary and styles, frontal view. —D. Cross section of ovary. —E. Remnants of filaments and staminal tube. Based on *Maguire 27625*.

long, subtending inflorescence axes, along axes, and subtending flowers; pedicels 1–2 mm long; sepals 5, ovate, acute, 2–3 mm long in young fruit, persistent; petals unknown, already fallen off; stamens 10; filaments 2.8 mm long, enlarged at base where connate with base of staminal ring, staminal ring 1.0–1.1 mm wide; ovary 3–4 mm long, the 3 styles free, ascending and each 1–1.2 mm long, glabrous. *Fruit* a three-seeded, ovoid, fleshy drupe 5–8 mm long, 5 mm broad at base; seeds angular.

Ecology and distribution. This species occurs as a shrub or small tree near the summit of Cerro Sipapo on rocky substrate. It is known only from this mountain in western Amazonas state, Venezuela, at altitudes between 1500 and 2000 m.

This species is different from other *Roucheria* species in both habitat and morphology. It is the only species in the genus that occurs in upper montane areas, and it is one of two species in the genus with subsessile, decurrent leaves, the other being *R. monsalveae* from the hyperwet, lowland forests of Bajo Calima, Valle Department, Colombia. The parenchyma cells of *Roucheria sipapoensis* in the petiole and lamina are the thickest seen for any species in the genus (~14–14.5 μm thick), and the epidermal cells are strongly lignified, giving the leaves an especially coriaceous texture.

Roucheria sipapoensis can be distinguished vegetatively from *R. monsalveae* by the auricular leaf blade bases (the leaf margins are strongly inrolled at the base), and the generally smaller blades (1.8–8.5 × 0.5–2.5 cm in *R. sipapoensis* vs. 3.5–15 × 1.5–4.0 cm in *R. monsalveae*), which also dry somewhat olive-gray compared to the dark brown-red drying color in *R. monsalveae*. *Roucheria sipapoensis* further differs in having paniculate, subterminal inflorescences, as opposed to the axillary, sessile fascicles of *R. monsalveae*. In the Ramírez et al. (1999) treatment for the Venezuelan Guayana, this species was called "*Roucheria* sp. *A*."

Paratypes. VENEZUELA. **Amazonas:** Cerro Sipapo (Paraque) tepui, near summit, peak I, 1798 m, 12 Dec. 1948, *Maguire & Politi 27625* (NY, VEN); Cerro Sipapo in Sabana Grande, vicinity of Campo Grande, 1500 m, 21 Jan. 1949, *Maguire & Politi 28697* (NY, VEN); Cerro Sipapo (Paraque) tepui among rocks, South Rim and East Rim, 1829–1981 m, 26–28 Jan. 1949, *Maguire & Politi 38639* (NY, VEN).

Hebepetalum neblinae Jardim & P. E. Berry, sp. nov. TYPE: Venezuela. Amazonas: Río Mawarinuma, near Cerro de la Neblina in terra firme forest, 00°50′N, 66°10′W, 140 m, 11 Feb. 1985, *B. Boom et al. 5729* (holotype, NY; isotype, F).

Haec species a congeneris foliis apice emarginatis distinguitur.

Tree ca. 10 m tall. Mature stems frequently with hollow pith. *Leaves* alternate, entire, repand, obovate, coriaceous, emarginate at apex, decurrent at base, 7.0–15.5 cm long, 2.8–7.8 cm wide; secondary venation broquiodromous, 2–5 mm between veins, terminating in a submarginal collecting vein, intersecondary veins present, midvein raised abaxially, submarginal collecting vein irregular, 0.05–3.0 mm from margin; repand margin with small, inconspicuous glands; petioles slightly bulbous at base, adaxially acanalate, 3–9 mm long; stipules caducous. *Inflorescence* a terminal, many-flowered panicle with 1 or 2 linear leaf-like bracts, to approximately 3 cm long and 0.8 cm wide; bracteoles triangular, 1.5–2.0 mm long; pedicel 0.5 mm long in flower, elongating to 2 mm long in fruit; sepals 5, ovate, acute, ca. 2 mm long, 1 mm wide; petals undeveloped; stamens 10, of two heights united in a basal ring 0.3 mm wide, filaments 10, five 0.9 mm long, five 0.5 mm long; anthers saggitate, bivalved with longitudinal dehiscence; ovary 1 mm long; locules 5, commonly two of these aborted; placentation axile; styles 5, stigma villous. *Fruit* a 5-seeded drupe 5–6 mm long; endocarp bony with 5 costae and intercostal ridged processes.

Ecology and distribution. This species is known from three localities in southern Venezuela and northern Amazonian Brazil, all in wet, lowland, nonflooded forest on white sand.

Hebepetalum neblinae is distinct from other species of *Hebepetalum* in the strongly coriaceous leaves with emarginate apices. Unique features in the leaf anatomy of this species include scattered druse crystals in the leaf blade, contrasting with the typical condition in the genus of absence of crystals, and subepidermal, abaxial mucilage cells, also absent in other species in the genus. In the Ramírez et al. (1999) treatment for the Venezuelan Guayana, this species was called "*Hebepetalum* sp. *A*."

Paratypes. BRAZIL. **Amazonas:** Municipio Sta. Isabel do Rio Negro, 0.7 km atrás da cidade de Sta. Isabel, próximo ao antigo aeroporto, caatinga alta, solo arenoso humoso, 00°22′S, 64°59′W, 100 m, 10 Oct. 1987, *C. A. Ferreira 9339* (INPA).

KEY TO THE GENERA OF NEOTROPICAL HUGONIACEAE

1a. Leaf venation broquiodromous (secondary veins joined together in a series of conspicuous, well-formed arches near the margin), petals clawed at base, ovary pubescent . . . . . *Hebepetalum*

1b. Leaf venation camptodromous with closely parallel secondary veins, not joined in a series of conspicuous arches, petals not clawed at base, ovary glabrous . . . . . *Roucheria*

KEY TO THE SPECIES OF *ROUCHERIA*

1a. Leaves and young twigs pubescent . . . . . *Roucheria schomburgkii* Planchon
1b. Leaves and young twigs glabrous.
  2a. Inflorescence an axillary fascicle.
    3a. Leaf base cuneate . . . . . *Roucheria calophylla* Planchon
    3b. Leaf base decurrent . . . . . *Roucheria monsalveae* A. H. Gentry
  2b. Inflorescence axillary or terminal panicles, never fasciculate.
    4a. Flowers in axillary short panicles 1–4 cm long.
      5a. Leaves strongly coriaceous, lamina margin abaxially inrolled, shrubs to small trees <10 m tall . . *Roucheria sipapoensis* Jardim & P. E. Berry
      5b. Leaves not coriaceous, lamina margin not inrolled, trees >15 m tall . . . . . *Roucheria elata* Planchon
    4b. Flowers in terminal panicles >5 cm long.
      6a. Flowers in glomerules . . . . . *Roucheria laxiflora* H. Winkler
      6b. Flowers never in glomerulous clusters . . . . . *Roucheria columbiana* Hallier f.

KEY TO SPECIES OF *HEBEPETALUM*

1a. Leaf apex emarginate . . . . . *Hebepetalum neblinae* Jardim & P. E. Berry
1b. Leaf apex acuminate.
  2a. Fruit with 4 locules, 4-stylous . . . *Hebepetalum roraimense* Secco & S. M. B. Silva
  2b. Fruit with 5 locules, 5-stylous . . . *Hebepetalum humiriifolium* (Planchon) Bentham

Acknowledgments. The first author thanks the Missouri Botanical Garden for a Bovard fellowship, permitting the study of these plants, and the second author acknowledges support from the National Science Foundation (grants BSR-8717303 and BSR-9201044).

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A New Name and a New Lectotypification in Neotropical Plants (Ebenaceae, Solanaceae)

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ABSTRACT. A new name in *Diospyros*, *D. panamense* S. Knapp, is coined to replace the homonymic *D. whitei* S. Knapp, and the name *Brunfelsia cuneifolia* J. A. Schmidt in Martius is lectotypified correctly with an extant specimen.

The following errors have come to light and are corrected here.

During the preparation of the account of Ebenaceae for *Flora Mesoamericana*, two new taxa of *Diospyros* were described (Knapp, 1997). One of these, *D. whitei* S. Knapp, was named in honor of the late Frank White, life-long student of the genus. Unfortunately, the epithet had been published just prior to that date for an African species, *D. whitei* Dowsett-Lemaire & Pannell (Dowsett-Lemaire & Pannell, 1996), also in honor of the late Frank White. This necessitates a new name for the Mesoamerican taxon.

Diospyros panamense S. Knapp, nom. nov. Replaced name: *Diospyros whitei* S. Knapp, Novon 7: 258. 1997. Not *Diospyros whitei* Dowsett-Lemaire & Pannell, Bull. Jard. Bot. Nat. Belg. 65: 399. 1996. TYPE: Panama. San Blas: Río diablo y vecinidad de Duque Sui, a unos 10 km de la costa frente a la Isla de Nargana, ruta hacia Cerro Ibedón, 80–110 m, 9°22′N, 78°35′W, *H. Herrera et al. 1175* (holotype, BM; isotypes, MO, PMA).

The new epithet is derived from the country of origin of the only known specimens, Panama.

After the publication of the monograph of *Brunfelsia* (Solanaceae) by the late Tim Plowman (Plowman, 1998), edited by S. Knapp and J. R. Press, Fred Barrie (MO) kindly alerted to us to our (SK & JRP) incorrect lectotypification of *Brunfelsia cuneifolia* J. A. Schmidt using a photo of a destroyed B sheet, as specified by Plowman in his unpublished thesis. We also contravened Article 37.5 of the *Code* (Greuter et al., 1994) by not citing the herbarium in which the photograph was housed, rendering the lectotypification in Plowman (1998) invalid.

In describing *Brunfelsia cuneifolia*, Schmidt (1864) cited two specimens: "In Brasilia australiore: Sellow nr. 4016 in hb. Berol. In sylvis paludosis inundatisque prope S. Jozé prov. S. Pauli: Riedel nr. 1467 in hb. Petropol." *Reidel 1467* in LE is clearly a specimen of *B. obovata* Bentham (Plowman, 1998). The Sellow collection in B cited by Schmidt (*Sellow 4016*) was destroyed in the Berlin herbarium, but two unnumbered Sellow collections housed at F and M appear to be duplicates as they "conform in every way" (Plowman, 1998) to the photograph of the destroyed Berlin sheet. Many Sellow duplicates were distributed without numbers. Plowman's treatment of the specimen in F as an isosyntype is accepted here, and thus it is possible to lectotypify *B. cuneifolia*. Plowman (1974, 1998) indicated that he wished to lectotypify *B. cuneifolia* with the destroyed B sheet, as good photographs of it exist. This, however, is contrary to Article 9.9 of the *Code* (Greuter et al., 1994), which states that original material must be used for lectotypification; the photographs were taken later and did not form part of the protologue. It is also contrary to Article 9.11: "If a holotype or previously designated lectotype has been lost or destroyed and it can be shown that all other original material differs taxonomically from the destroyed type, a neotype may be selected to preserve the usage established by the previous lectotypification." Since the previous lectotypification (Plowman, 1998) was invalid, duplicates of the syntypes exist, and one of the two syntypes of *B. cuneifolia* is attributable to another taxon (*B. obovata* Bentham), it is clear the species needs correct lectotypification to prevent future confusion. I correctly and unambiguously lectotypify *B. cuneifolia* J. A. Schmidt here, using the unnumbered Sellow specimen at F annotated by Plowman as "isotype" as the new lectotype.

Brunfelsia cuneifolia J. A. Schmidt, in Martius, Fl. Bras. 8(1): 259. 1864. TYPE: Brazil. "In Brasilia australiore," *Sellow [4016]* (lectotype, designated here, F; isolectotype, M; photo-

graphs of destroyed sheet at B (F neg. 621824, as *Sellow 4016*), F, NY, US).

Acknowledgments. I thank Alison Strugnell (FHO) and Fred Barrie (F, MO) for alerting me to these errors, and Mike Gilbert (MO, BM) and two anonymous referees for careful review of the manuscript.

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Bauhinia wuzhengyii (Leguminosae, Caesalpinioideae), a New Chinese Species

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ABSTRACT. *Bauhinia wuzhengyii*, a new species from Yunnan, China, is described and illustrated. Its relationship within the section *Loxocalyx* is discussed. The section *Loxocalyx* Bentham, containing the new species, is reinstated based on re-assessment of the obliquely campanulate hypanthium and free gynophore.

During a visit to the Chinese Kunming Institute of Botany in May 1997, the author, who has been invited to act as co-author of *Bauhinia* for *Flora of China*, went through the herbarium of the genus. Here a specimen of an undescribed species was discovered. This sheet had been annotated (in 1959) by the eminent Chinese botanist Wu Zhengyi as *Bauhinia cinnamomifolia* sp. nov. This name, however, has been ascribed to section *Cinnamomifolia* under *Phanera*, a group to which this species clearly does not belong. From discussions with Prof. Wu it was evident that he had no plans to describe this species. It is therefore a great pleasure to dedicate this new species to him.

Bauhinia wuzhengyii S. S. Larsen, sp. nov. TYPE: China. Yunnan: Malipo County, Tian Bas, in thin forest on mountain slope, 480 m, 27 July 1958, *Hu Yue Ying & Wen Shao Kong 580812* (holotype, KUN). Figure 1.

Bauhinia wuzhengyii species nova sectionis *Loxocalycis*, *Bauhiniae wallichii* MacBride affinis a qua differt foliis integris, stigmate subsessile.

Liana, tendrils not seen. Flowering branches terete, glabrous. Leaf lamina entire, elliptic, 9.0–10.3 × 4.8–5.3 cm, glabrous both sides, base attenuate, apex abruptly acuminate; nerves 3; stipules not seen; petiole 2.3–3 cm long, thickened at both ends. Inflorescence terminal, an elongated raceme, with 2 racemes evident on type, one with a reduced leaf at base. Inflorescence axis up to 19 cm long, finely grayish pubescent; bracts 4–5 mm long, setaceous, finely pubescent outside; bracteoles similar but minute, 0.5 mm long, subopposite, inserted below the middle of the pedicel; pedicel 2.5–3 cm long, finely grayish pubescent. Flower buds ellipsoid, 9–10 × 5–6 mm, finely grayish pubescent; hypanthium obliquely campanulate, enlarged adaxially, ca. 4 mm, twice the length of abaxial portion (Fig. 2A, B), apically pubescent except middle part of adaxial margin (Fig. 2F). Calyx 3–4 mm long, campanulate (occasionally slightly bilabiate, Fig. 2B), open in bud, split in upper half to 5 lobes, each with acute apex, finely grayish pubescent outside, inside glabrous to sparsely pubescent. Corolla with 5 subequal petals, 4 lateral ones spathulate, 7–10 mm long including a 2–3-mm claw, densely brownish pubescent on both sides, becoming glabrous toward claw; posterior petal ± obovate-oblong, carinate, basally fleshy, ca. 2 mm, with claw indistinct, upper portion, ca. 5 mm, finally reflexed, inside glabrous, outside pubescent in upper portion, marginally and basally glabrous. Fertile stamens 3; filaments ca. 10 mm long, glabrous; anthers 1.5–2 mm long, glabrous, dehiscing longitudinally; staminodes 5–7, 3 posterior forming a 3-dentate connate structure, 1.5 mm long (Fig. 2F); middle connate staminode slightly larger, inflated at base to a low rim, the 2 lateral teeth inserted behind the rim; 1–2 minute staminodes at both sides of the teeth and 1–2 minute staminodes between the fertile stamens. Pistil with thick stipe, free, 2–3 mm long, brownish woolly pubescent, inserted at lower abaxial side of hypanthium (Fig. 2F); ovary ca. 9 mm long, brownish woolly pubescent throughout, stigma subsessile, ± punctate, style glabrous, very short, ca. 1 mm. Ovules ca. 8. Pods not seen.

Distribution and habitat. Only known from the type locality.

DISCUSSION

Bauhinia wuzhengyii is here described based on a single collection in KUN, as the author was unable to locate any iso- or paratypes (see Note 1). After my experience of revising the genus *Bauhinia* for *Flora Malesiana* and the Indochinese floras, this new species is, however, so striking in both flower

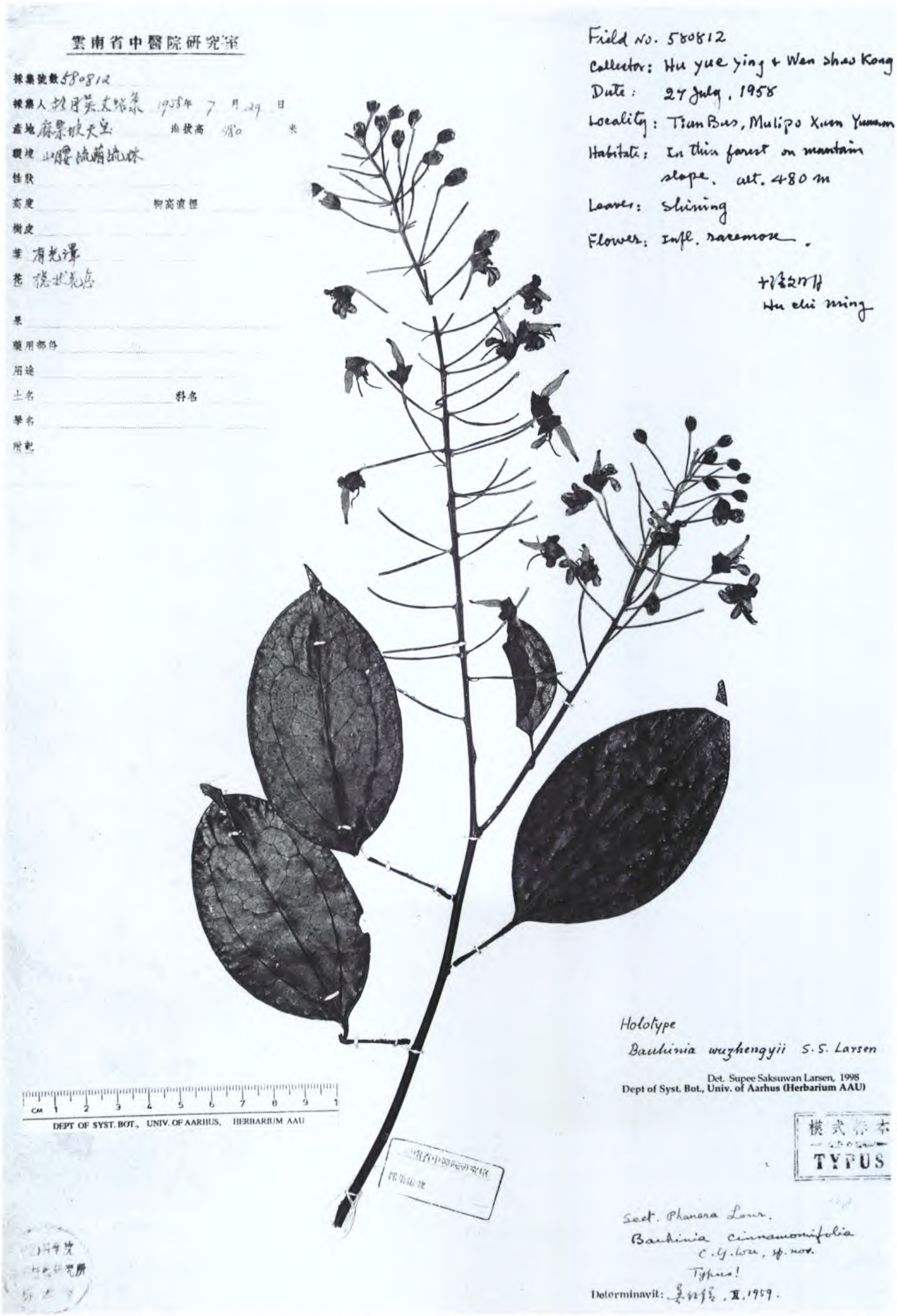

Figure 1. *Bauhinia wuzhengyii* S. S. Larsen; holotype specimen, *Hu Yue Ying & Wen Shao Kong 580812* (KUN).

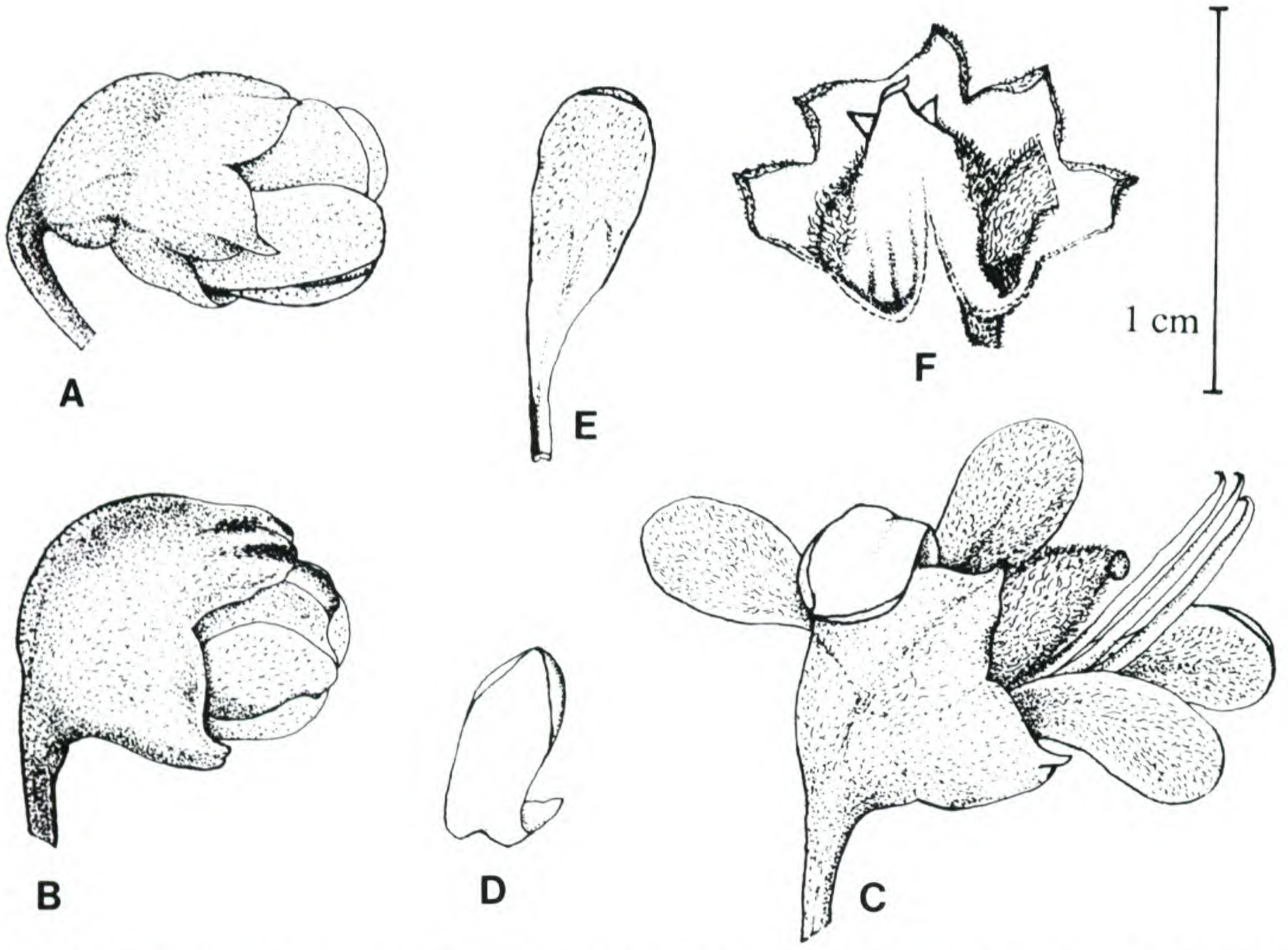

Figure 2. *Bauhinia wuzhengyii.* —A. Floral bud, lateral view, showing typical campanulate calyx. —B. Floral bud, lateral view, showing occasional bilabiate condition. —C. Open flower (anthers missing). —D. Posterior petal, upper surface. —E. Lateral petal, upper surface. —F. Calyx and hypanthium seen from inside showing ovary and the dentate, staminodial body. Drawn from *Hu Yue Ying & Wen Shao Kong 580812.*

and leaf morphology that I am not in doubt that it deserves specific status.

Bauhinia wuzhengyii belongs to the section *Loxocalyx* Bentham (Syn.: series *Loxocalyx* (Bentham) Wunderlin, Larsen & Larsen, 1987) together with *B. wallichii* MacBride and *B. japonica* Maximowicz. These three species have a free gynophore (stipe) inserted at the lower or upper abaxial side of the hypanthium. The new species is easily distinguished from these two other species by having entire leaves with 3 nerves, a subsessile stigma, and a 3-dentate, staminodial structure. *Bauhinia japonica* has bilobed leaves (⅓–⅔ of the length), while *B. wallichii* has leaves emarginate to bilobed (⅓ of the length); both species have 9–13-nerved leaves, distinct style, and a 5-digitate staminodial structure. *Bauhinia japonica* is a coastal species distributed from Japan to Hainan, extending to a single locality along the coast of Kwangtung (Larsen & Larsen, 1982). *Bauhinia wallichii* is distributed from India (Silhet, Assam) to Myanmar and northern Vietnam (Larsen et al., 1980). *Bauhinia wallichii* was recently reported from southeastern Yunnan by Zhang and Chen (1996) and from northern Thailand (S. S. Larsen, in press).

The tri-nerved leaves with entire margins of *Bauhinia wuzhengyii* are similar to those in section *Tubicalyx* Wunderlin, Larsen & Larsen (1987). Despite superficial similarities between floral structures, the *Tubicalyx* group is distinguished by hypanthia not being oblique, gynophores adnate to the hypanthium wall, and all the staminodes being free and not connate as a compound structure.

The pollen grains of *Bauhinia wuzhengyii* are 3-colporate (Fig. 3A) with rugulose tectum (Fig. 3B, C). Pollen of this new species belongs to the curtisii pollen type, grouping together with *B. japonica* (S. S. Larsen, 1975) and *B. wallichii* (S. S. Larsen, in press).

In conclusion, the morphology and palynology point to this species being related to *Bauhinia wallichii* and *B. japonica.* It must, however, be emphasized that very little pollen has been available for SEM studies. Further studies, including sectioning of pollen, are highly needed for a comparison with other members of the curtisii pollen type.

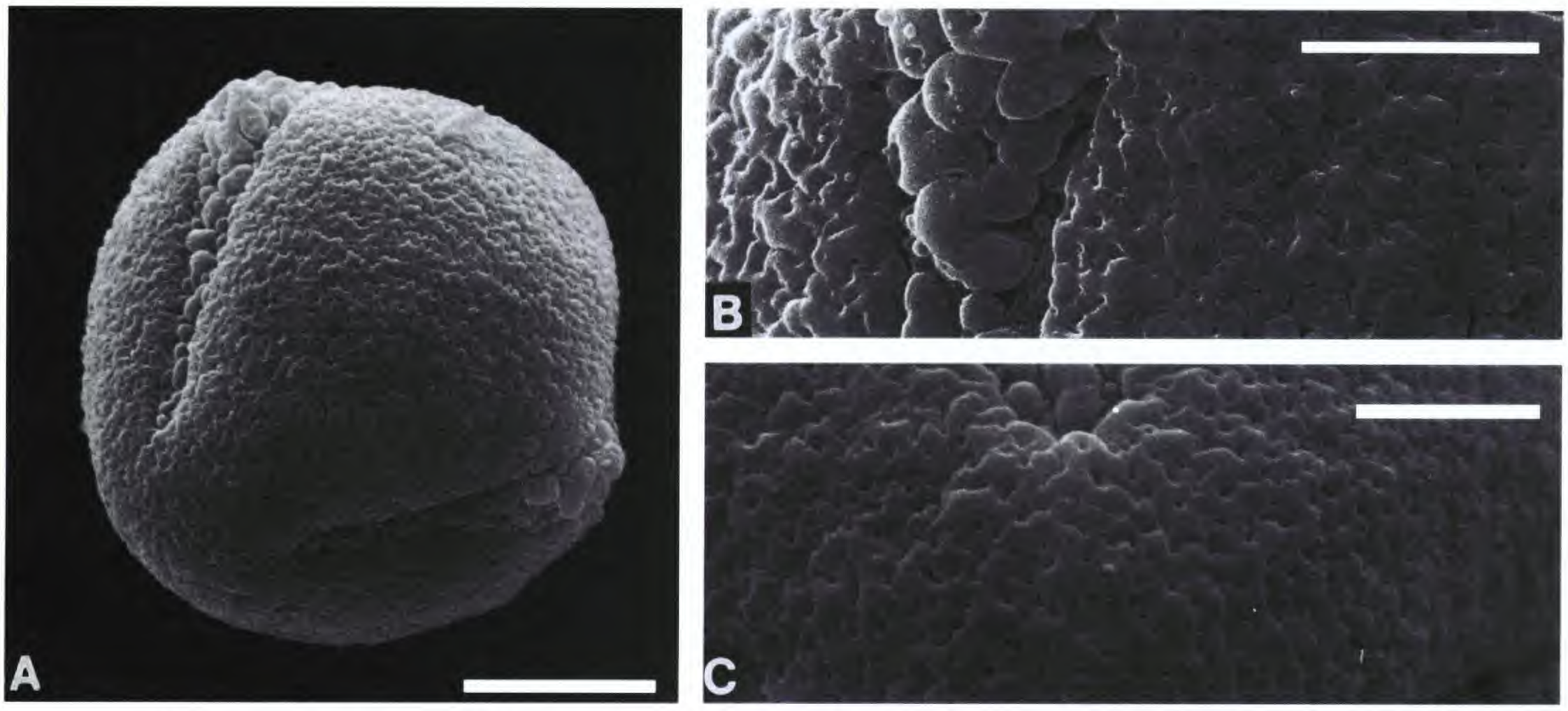

Figure 3. *Bauhinia wuzhengyii.* SEM micrographs of non-acetolyzed pollen. —A. Whole pollen grain, oblique view. —B, C. Detail of tectum at mesocolpia and apocolpia. Scale bar for A = 10μm; scale bar for B and C = 5 μm.

Note 1. Zhang (1993) reported a *Bauhinia strychnoidea* Craib from Yunnan, probably referring to *B. strychnifolia* Craib, as *B. strychnoidea* Prain is a Malaysian species. This record is based on the same collecting number as the type of *B. wuzhengyii.* Dr. Zhang (pers. comm.) has seen material either in Kunming (KUN) or in Xishuangbanna (HITCB), but his determination does not appear on the holotype specimen.

Note 2. Since the work by Wunderlin et al. (1987), knowledge on the variation and structure of floral characters in *Bauhinia* has considerably increased. Consequently, the section *Loxocalyx* Bentham (1865) is reinstated under *Bauhinia* subg. *Phanera.* This was earlier referred to as series *Loxocalyx* Wunderlin, Larsen & Larsen (1987); Zhang (1996) raised series *Loxocalyx* to a subsection, transferring it to section *Lasiobema,* but in this we cannot follow him for the diagnostic reasons listed below.

Bauhinia [subg. *Phanera*] section **Loxocalyx** Bentham (1865), emended description:

Differs from other sections of subgenus *Phanera* by the campanulate, 5-dentate calyx open in bud; the hypanthium being obliquely campanulate, with the adaxial side twice as long as the abaxial and with the posterior staminode forming a dentate or digitate, fleshy structure; the gynophore (stipe) free, inserted on the lower or upper abaxial side of the hypanthium, and the stigma ± punctiform.

Acknowledgments. The author is indebted to Hu Chi Ming for translating the Chinese texts on the label, to Benjamin Øllgaard for latinizing the diagnosis, to Anni Sloth for technical work on pollen and photography, and to Oratai Kirdkaew for preparing the line drawing from sketches made by the author. The stay in Yunnan was sponsored by the Academia Sinica; a grant from the Carlsberg Foundation covered the travel expenses to China. Warm thanks are also extended to the staff of the botanical institutes in Kunming and Xishuangbanna.

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Landoltia (Lemnaceae), a New Genus of Duckweeds

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ABSTRACT. Morphological, allozyme, and cpDNA (*rbc*L) sequence data provide evidence for the distinctness of *Spirodela punctata* from species in both *Lemna* and *Spirodela* (Lemnaceae). We propose the recognition of a new genus, *Landoltia*, to better reflect current phylogenetic concepts in the Lemnaceae. *Landoltia* is distinguished by its reduced frond prophyllum, frond nerves (3 to 7), roots (up to 7), root tracheids, external anther locules, and also by well-supported molecular evidence provided by allozymes and cpDNA sequences. The new combination *Landoltia punctata* is made to accommodate this taxonomic modification.

Duckweed classification remains equivocal because phylogenetic relationships are difficult to reconcile in this diminutive, reduced family (Les et al., 1997b). The most comprehensive phylogenetic hypotheses for duckweed taxa were presented in a monograph by Landolt (1986) and form the basis of modern classification for the family Lemnaceae.

In the most recent monograph of the duckweed family (Lemnaceae), Landolt (1986) recognized four genera: *Lemna*, *Spirodela*, *Wolffia*, and *Wolffiella*. Few additional genera have been proposed in past taxonomic treatments of duckweeds. One example is *Staurogeton* Reichenbach, which was elevated from subgeneric to generic rank by Schur (1866) to accommodate the morphologically distinctive *Lemna trisulca* L. (Landolt, 1986). Most contemporary classifications continue to assign this taxon to the genus *Lemna*. Den Hartog and van der Plas (1970) subdivided *Wolffiella* to create the two genera *Pseudowolffia* and *Wolffiopsis*. Few taxonomic treatments recognize either of these segregate genera as distinct from *Wolffiella*. To our knowledge, division of either *Spirodela* or *Wolffia* into subsidiary genera has not yet been suggested, although some authors have transferred certain species from these genera into either *Lemna* or *Wolffiella*. Landolt's recent generic concept of *Spirodela* recognizes a paraphyletic taxon, with *S. polyrhiza* and *S. intermedia* as sister species, but with *S. punctata* associating with *Lemna* (Fig. 1A).

Although Landolt's evolutionary trees reflect a keen understanding of duckweeds and a comprehensive evaluation of published taxonomic literature on the group, they were constructed using non-explicit phylogenetic methods, i.e., not by cladistic analyses. We have re-analyzed results of these earlier studies using cladistic methodologies to test hypothetical relationships proposed by Landolt. In addition, we have generated several molecular data sets to supplement the clearly limited number of phylogenetically informative characters available for these morphologically simple plants. Although this work remains in progress, the results of our preliminary analyses of morphological, biochemical, allozyme, and DNA (*rbc*L) sequence data (Crawford & Landolt, 1993, 1995; Crawford et al., 1995, 1997; Crawford et al., 1996; Les et al., 1994, 1997a, 1997b) are reasonably concordant with Landolt's classification, but differ in a number of details from his phylogenetic diagrams. In particular, generic subdivisions used in his classification of Lemnaceae are inconsistent with results of these phylogenetic analyses and merit reconsideration. Herein we summarize evidence that warrants the taxonomic segregation of a new duckweed genus. We consider this taxonomic action essential for a classification that reasonably depicts our best, current estimate of phylogenetic relationships in the Lemnaceae.

A specific diagram of intergeneric duckweed relationships that summarizes the phylogenetic trees originally appearing in Landolt (1986) was provided to us by E. Landolt. We compared these hypothetical relationships to published allozyme studies (Crawford & Landolt, 1993) and to previous cladistic analyses of morphological, anatomical, and biochemical data (Les et al., 1997b). Intergeneric duckweed relationships were also examined using preliminary results of a phylogenetic analysis of

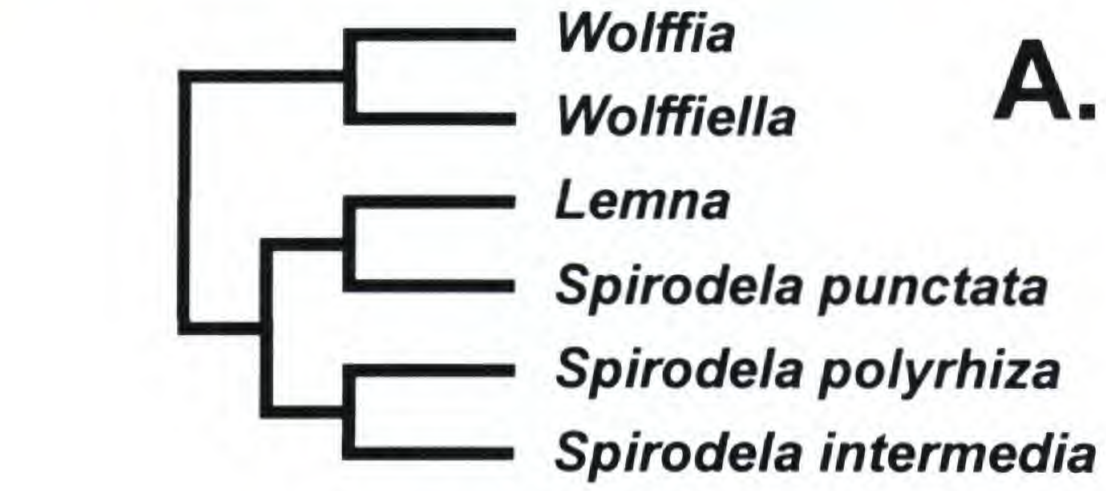

Figure 1. Phylogenetic position of *Spirodela punctata* as indicated in several recent studies. —A. Landolt (1986) hypothesized the association of *S. punctata* with *Lemna*, in a paraphyletic concept of *Spirodela*.—B. Non-molecular data (Les et al., 1997b) place *S. punctata* in a separate clade from *Lemna*, but also apart from other *Spirodela* species (bootstrap % shown). —C. Molecular (*rbc*L) data provide strong support (bootstrap % shown) for the distinctness of *S. punctata* from either *Lemna* or *Spirodela* (Les et al., 1997b). All evidence points to an isolated position of *S. punctata* in the Lemnaceae, and its recognition as a distinct genus is compatible systematically with any of these results.

*rbc*L sequence data for the Lemnaceae (Les et al., 1997b).

Non-molecular data (Fig. 1B) resolve the entire genus *Spirodela* as paraphyletic. However, *S. punctata* lies distinct from the other *Spirodela* species as a separate branch, and with good internal support (75% bootstrap value). Strong bootstrap values (99% and 84%, respectively) from molecular (*rbc*L) data (Fig. 1C) support *S. polyrhiza* and *S. intermedia* as sister species, and also their distinction from *S. punctata*. Allozyme data (Crawford & Landolt, 1993) show a moderate genetic identity between *S. polyrhiza* and *S. intermedia* ($I = 0.404$), yet they share no electrophoretically detectable alleles with *S. punctata* ($I = 0.000$). Various morphological features (Table 1) are consistent with a phylogenetic position for *S. punctata* intermediate between *Lemna* and other *Spirodela* species. By inspection of these features, the species *S. punctata* is not only morphologically distinct from both *Lemna* and *Spirodela*, but intermediate and transitional between these genera.

Presently, *Spirodela* Schleiden comprises three distinct species: *Spirodela intermedia* W. Koch, *S. polyrhiza* (L.) Schleiden, and *S. punctata* (G. Meyer) C. H. Thompson. Landolt (1986) placed the former two species into *Spirodela* sect. *Spirodela*, and segregated the latter in section *Oligorrhizae* W. Koch. *Spirodela punctata* has been taxonomically problematic because it possesses features similar to both *Spirodela* and *Lemna* (Table 1; Landolt, 1986).

Meyer (1818) originally named *Spirodela punctata* as *Lemna punctata*, but it was not until 50 years later that Hegelmaier (1868) transferred the taxon (as *S. oligorrhiza*) to *Spirodela*. In Meyer's time, all Lemnaceae were included in the genus *Lemna*. The new genera *Spirodela* and *Wolffia* were created in 1839 and 1844, respectively, and *Wolffiella* was established in 1895 (Landolt, 1986). It is

Table 1. Morphological features compared among species of *Spirodela* and *Lemna*. *Spirodela punctata* is intermediate between *Lemna* and other *Spirodela* species for the character states indicated (from Landolt, 1986, 1998; Shih, 1979).

Feature	*S. intermedia; S. polyrhiza*	*S. punctata*	*Lemna*
Prophyllum at base of frond	present	present, but reduced	absent
No. of veins in frond	7 to 16	3 to 7	1 to 5
No. of roots	7 to 21	1 to 7 (12)	1
Root tracheids	extend to tip	basal only	absent
Dorsal meristem of new fronds	on one side[1]	on both sides	on both sides
External anther locules	do not extend above internal locules	extend slightly above internal locules	extend above internal locules

[1] Lateral on other side.

the merit of Hegelmaier (1868, 1895) to have clearly separated the genera *Lemna* and *Spirodela*. He also demonstrated accurately and comprehensively the special position of *S. punctata* (called *S. oligorrhiza*) within the genus *Spirodela*.

Spirodela punctata is very polymorphic in relation to size, pigmentation, number of roots, and veins. The high level of variability led Hegelmaier (1895) to distinguish two species (*S. oligorrhiza* and *S. pusilla*) and to describe three other species of questionable status. Growth experiments (Landolt, 1986; Landolt & Kandeler, 1987) and allozyme studies (Crawford & Landolt, 1993) have demonstrated that genetic variation in *S. punctata* is rather limited, and many of the differences used to distinguish former taxa are induced environmentally.

Thompson transferred *L. punctata* to *Spirodela* in 1898. Landolt (1986) observed that some authors have merged the genera *Lemna* and *Spirodela* because of their similar appearance and because the features of *S. punctata* are transitional between the genera. Yet, he clearly differentiated *Spirodela* (including *S. punctata*) from *Lemna* by the reduced prophyllum at the base of its fronds, druse crystals, pigment cells, multiple roots, better developed tracheids, and other anatomical/morphological features (Landolt, 1986). To our knowledge, the generic distinctness of *S. punctata* from both *Spirodela* and *Lemna* has not been suggested previously.

We have now examined relationships of duckweed genera using morphological, anatomical, flavonoid, allozyme, and *rbc*L sequence data. As summarized in Figure 1, analyses of these data sets indicate that *Spirodela punctata* represents an isolated clade distinct from both *Spirodela* and *Lemna*. Cladograms constructed from either morphological or flavonoid data (or their combination) show high internal support (75–97% bootstrap values) for the distinctness of *S. punctata* from section *Spirodela* (Les et al., 1997b) and support Landolt's original phylogenetic concept that recognized *Spirodela* as paraphyletic with respect to the position of *S. punctata* (Landolt, 1986).

Allozyme data (Crawford & Landolt, 1993, & unpublished) indicate a complete lack of genetic identity between *S. punctata* and any species in either *Lemna* or *Spirodela*, yet the two species of *Spirodela* sect. *Spirodela* do retain a moderate genetic identity. Chloroplast DNA (*rbc*L) sequence data (Les et al., 1997b) resolve *S. punctata* in a clade between *Spirodela* and *Lemna* but not within either genus. In summary, these results echo the transitional nature and unsettled taxonomic status of *S. punctata* manifest in prior systematic investigations. Phylogenetically, our broad-based/wide-ranging studies indicate that *S. punctata* is indeed transitional between, but not a member of either *Lemna* or *Spirodela*. It is for this reason that we establish a new genus to better reflect this revised hypothesis of duckweed relationships.

Landoltia D. H. Les & D. J. Crawford, gen. nov. TYPE: *Lemna punctata* G. Meyer: Prim. Fl. Esseq. 262. 1818. ≡ *Landoltia punctata* (G. Meyer) D. H. Les & D. J. Crawford.

Herbae ex radicibus 2 ad 7 (raro 1 vel 8 ad 12) usque ad 7 cm longis, omnibus prophyllum perforantibus; turionibus absentibus. Frondes in summa aqua natantes, ovatae ad lanceolatae, 1.5–2.0-plo longiores quam latiores, supra nitidae viridesque serie mediana papillarum ornatae, subtus laeves rubraeque; nervis 3 ad 7. Flores infrequentes; antherae loculis externis super internos positis. Fructus ala laterali in parte supera praedita; seminibus 1 vel 2 manifeste 10 ad 15-costatis.

Roots 2 to 7 (rarely 1 or 8 to 12), up to 7 cm long, all perforating the prophyllum. Turions absent. Fronds floating on the surface of the water, ovate to lanceolate, 1.5–2 times longer than wide, above shining and green with a medial series of papillae, below smooth and red; veins 3 to 7. Flowers infrequent; external locules of the anther above the internal locules. Upper part of fruit with a lateral wing; seeds 1 or 2 with 10 to 15 distinct ribs.

Landoltia punctata (G. Meyer) D. H. Les & D. J. Crawford, comb. nov. Basionym: *Lemna punctata* G. Meyer, Prim. Fl. Esseq. 262. 1818. *Spirodela punctata* (G. Meyer) C. H. Thompson, Rep. (Annual) Missouri Bot. Gard. 9: 28. 1898. TYPE: Chile. Tierra del Fuego Island, Orange Harbor, leg. Wilkes expedition 1838 (neotype, US not seen; isoneotypes, DS, GH, KANU, MO not seen).

Lemna oligorrhiza Kurz, J. Linn. Soc., Bot. 9: 267. 1866. *Spirodela oligorrhiza* (Kurz) Hegelmaier, Die Lemnaceen 147. 1868. TYPE: India. Calcutta, *Kurz 1865* (holotype, CAL? not seen; isotypes, K, MEL, U not seen).

The generic name *Landoltia* commemorates Elias Landolt for his outstanding contributions to the systematics and biology of Lemnaceae in his more than 45 years of research on duckweeds.

Acknowledgments. We thank D. Keil for his assistance in preparing the Latin diagnosis and R. Rutishauser for his helpful comments. This work was supported in part by NSF grant DEB-9806537 to the authors.

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A New Combination in Gabonese *Synsepalum* (Sapotaceae)

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ABSTRACT. *Gambeya nyangensis* is shown to have been based on a mixed collection. The name is lectotypified and the species, with an amended description, is transferred to *Synsepalum*.

Gambeya nyangensis Pellegrin was recognized in 1924 and illustrated four years later (Pellegrin, 1928), based on *Le Testu 1786*, a collection from the Tchibanga region of southwestern Gabon. Included in this gathering were flower-bearing branchlets as well as detached seeds. Pellegrin's assumption that these two elements represented one species appears to have misled him in his generic placement of the species. He commented that in its general habit and reticulate foliar nervation, *G. nyangensis* approached *G. africana* (G. Don) Pierre, but offered no other justification for his recognition of the new species in *Gambeya*. However, the fact that the seeds of both *G. africana* and *G. subnuda* (Baker) Pierre (type species of *Gambeya*) resemble those assumed to belong to his new taxon in having a linear hilum may also have influenced his decision. That some doubt about it existed in his mind is suggested by his statement that the flowers of *G. nyangensis* are very similar to those of *Chrysophyllum* sect. *Zeyherella*, in particular those of *C. longipedicellatum* De Wildeman.

Aubréville (1961) stated flatly that *G. nyangensis* is not really a *Gambeya*. Nevertheless, lacking the intact fruit, he felt it best to leave the species there, while echoing Pellegrin's thoughts on *Zeyherella* and adding *Pachystela* and *Ecclinusa* to the list of generic candidates. Aubréville correctly pointed out that the seed of *Le Testu 1786* precludes the use of either *Pachystela* or *Zeyherella*.

Recent collecting in central Gabon has yielded specimens that resolve this puzzle. In January 1983 researchers at the Station d'Études des Gorilles et Chimpanzés in the Lopé Reserve found chimpanzee dung containing a Sapotaceae seed that did not correspond to any species illustrated by Aubréville (1961). Seeds of the same species were found several times over the years, during November–January, in both chimpanzee and gorilla dung (White & Abernethy, 1997: 186), but it was not until November 1990 that a fruiting specimen was located and collected. It proved impossible to identify this specimen, and a number of trees were monitored for flowering activity. In June 1996 flowering material was collected that matches very well the flower-bearing branchlets of the type of *G. nyangensis*. Since the recently collected seeds have a much wider hilum than do those of the type (>15 mm vs. ca. 3 mm), it is now evident that the type collection is a mixture, and the name is lectotypified below in accordance with Articles 9.9 and 9.10 of the *Code* (Greuter et al., 1994).

In Aubréville's key to genera in the *Flore du Gabon*, the recent material would lead to *Afrosersalisia*, but that genus is now recognized as a synonym of an inclusive *Synsepalum*, based on the convincing work of Pennington (1991). Other Gabonese genera similarly now included in *Synsepalum* are *Pachystela*, *Tulestea*, and *Vincentella*. The necessary combination in *Synsepalum* is made below, and an amended description of the species is presented.

Synsepalum nyangense (Pellegrin) McPherson & L. White, comb. nov. Basionym: *Gambeya nyangensis* Pellegrin, Bull. Mus. Hist. Nat. (Paris) 1924: 327. TYPE: Gabon. Mayombe bayaka, Tchibanga, 16 Sep. 1914, *Le Testu 1786* (lectotype, designated here, P flowering branchlets; isolectotype, MO).

Amended description: Tree 20–35 m, 40–80 cm DBH, sometimes with narrow buttresses 2–4 m high, trunk somewhat fluted, twisted, or irregular. Bark orange-brown or orange-gray, flaky. Exudate white. Leaves mostly clustered at ends of branchlets, these appressed-pubescent but quickly glabrate, 5–8 mm diam.; blades obovate or oblong, (11–)15–25(–31) cm long, (3.7–)5.5–10(–13) cm wide, base attenuate and smoothly merging with the

petiole, apex rounded but with a short (to 5 mm), obtuse acumen in undamaged leaves, midrib prominent abaxially, much less so adaxially, lateral veins (9–)10–12 on each side of the midrib, the finer venation subparallel and visible on both surfaces, these at first appressed-pubescent but quickly glabrate; petiole (1.5–)2–4.5 cm long, glabrate; stipules absent. Flowers in fascicles in the axils of fallen leaves; pedicels 4–5 mm, accrescent in fruit to 10–15 mm long, pubescent; calyx of 5 (rarely 6) sepals, 3 mm long, 2 mm wide, fused one-third to one-half of length, fawn, pubescent abaxially and adaxially; corolla of 5 (rarely 6) petals, glabrous, corolla tube 1 mm long, corolla lobes 1.5–3 mm long, imbricate in bud, green; stamens 5, inserted on the throat of the corolla tube, filaments ca. 1 mm long, usually kinked centrally, anthers apiculate, ca. 1 mm long; staminodes absent; ovary 5-locular, pubescent with pale brown hairs, style glabrous. Fruits 4–5.7 cm long (on drying), 2.5–3 cm diam., yellow-orange or yellow, flesh translucent white, sweet; seed 3.4–4.7 cm long including 2–3 mm apiculum, ca. 2 cm wide, ca. 1.5 cm thick, somewhat laterally compressed, hilum occupying ca. two-thirds of the seed surface, its surface shallowly reticulate, testa smoother but not shiny, embryo with plano-convex cotyledons, endosperm absent.

Flowering is in June–July, and fruits ripen from November to January. Immature seeds are eaten by black colobus, *Colobus satanas*. Ripe fruits are consumed in large quantities by gorillas (*Gorilla g. gorilla*) and chimpanzees (*Pan t. troglodytes*), both of which swallow seeds intact and disperse them in their dung, and by smaller primates that may transport seeds short distances from the parent tree.

The trees occur in patches in mature forest, often along ridge lines at ca. 500–700 m throughout the Lopé Reserve, reaching densities of 3–5 adult trees per hectare on Mount Yindo, at 00°13′S, 11°34′E, where they are particularly common.

Specimens studied. GABON. **Nyanga:** Mayombe bayaka, Tchibanga, 16 Sep. 1914, *Le Testu 1786* (MO, P). **Ogooué-Ivindo:** Lopé-Okanda Reserve, hill SW of SEGC, ca. 200 m, 15 Nov. 1993, *McPherson 16189* (LBV, MO); Lopé Reserve, West Woods Transect, open forest, 25 Nov. 1990, *L. White 0228* (MO); Lopé Reserve, Camel Ridge, Nov. 1993, *L. White 1172* (MO); Lopé Reserve, Camel Ridge, mature forest, 600 m, 17 Nov. 1995, *L. White 1527, 1528, 1529* (all MO); Lopé Reserve, Camel Ridge, mature forest, 700 m, 25 June 1996, *L. White 1597* (MO).

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Two New Brazilian Velloziaceae, *Vellozia auriculata* and *Vellozia gigantea*, and a Key to the Related Dracenoid Species of *Vellozia*

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ABSTRACT. Two new species of Velloziaceae, *Vellozia auriculata* and *V. gigantea*, from Espinhaço Range, Minas Gerais, Brazil, are described. Both are characterized by a large dracenoid habit. *Vellozia auriculata* has large tepal appendages and is endemic to the Ambrósio Range, northeast of the Diamantina plateau. It reproduces in an unusual way, with conspicuous vegetative propagation by lodging branches. *Vellozia gigantea* may attain a height of up to 6 m, being the largest species of *Vellozia* so far described. Its one known population is located within the limits of the National Park of Serra do Cipó. Morphological and anatomical descriptions as well as illustrations of both species are presented. Comments are made on their geographic distribution and putative taxonomic relationships. A key to the accepted species with dracenoid habit related to *Vellozia auriculata* and *V. gigantea*, and comments on the delimitation of this group are also presented.

Since the revision by Smith and Ayensu (1976), many additional Brazilian Velloziaceae have been described (Smith & Ayensu, 1979, 1980; Smith, 1985, 1986; Mello-Silva & Menezes, 1988; Mello-Silva, 1991, 1994, 1996, 1997; Menezes & Semir, 1991). This suggests that there are still a large number of undescribed species. Factors that support this conclusion are the restricted distribution of most of the species as well as the difficult access to wide areas of the Espinhaço Range in central Brazil, where the family reaches maximum diversity. The two species herein described are spectacular, both in terms of their morphology and their geographical distribution, constituting examples of the richness and uniqueness of the flora of the Brazilian *campos rupestres* (for maps, see Mello-Silva, 1994: 273, and Mello-Silva & Pirani, 1994: 149).

Vellozia auriculata and *V. gigantea* can be included in the group of *Vellozia* species with dracenoid habits, reaching more than 2 m high. Other dracenoid members of this group are *V. compacta* Martius ex Schultes & Schultes f., *V. glabra* J. C. Mikan, *V. piresiana* L. B. Smith, and *V. spiralis* L. B. Smith (Mello-Silva, 1995). Their stems are thickened at the base with leaves apically concentrated and soon deciduous, leaving persistent leaf sheaths. The flowers are long-pedicellate with violet tepals, numerous stamens (at least 18), and conspicuous staminal appendages, and the capsules have apical dehiscence. In addition, the anatomical structure of the leaf lamina is quite characteristic of the group, presenting an aquiferous hypodermis extending adaxially to bundle sheaths and furrows, as well as fibro-vascular bundles with two phloem strands. For phylogenetic interpretation of these external and anatomical characters, see Menezes et al. (1994) and Mello-Silva (in press).

KEY TO THE ACCEPTED SPECIES OF THE DRACENOID GROUP OF *VELLOZIA*

1a. Leaf lamina arcuate; peduncle and hypanthium always smooth.
  2a. Plants to 6 m tall; leaf arrangement densely imbricate; leaf sheaths brown but apically cinereous, obliquely truncate and sharp pointed at apex (Serra do Cipó) . . . *V. gigantea*
  2b. Plants to 3 m tall; leaf arrangement laxly imbricate; leaf sheaths lustrous brown throughout, evenly truncate at apex (Serra do Cipó to Diamantina) . . . . . *V. glabra*
1b. Leaf lamina plane; peduncle and hypanthium with emergences, rarely the hypanthium solely smooth.
  3a. Margins of leaf lamina smooth, serrate only at the base . . . . . *V. piresiana*
  3b. Margins of leaf lamina serrate throughout.
    4a. Outer tepals auriculate; hypanthium and capsule spheroid to obloid, ± as long as broad (Serra do Ambrósio) . . . . . *V. auriculata*
    4b. Outer tepals not auriculate; hypanthium and capsule oblong to obtriangular, longer than broad (Ouro Branco to Grão-Mogol).
      5a. Apex of leaf sheath and base of leaf lamina with short-ciliate, entire margins; hypanthium evenly covered with emergences (Grão-Mogol) . . . . . *V. spiralis*
      5b. Apex of leaf sheath and base of leaf lamina with serrate margins; hypanthium generally with emergences only at angles and base, if pres-

ent (Ouro Branco to Diamantina) . . . . . *V. compacta*

Vellozia auriculata Mello-Silva & N. L. Menezes, sp. nov. TYPE: Brazil. Minas Gerais: Mun. Rio Vermelho, Pedra Menina, Morro do Ambrósio, 31 Mar. 1985 (fl, fr), N. L. Menezes, A. M. Giulietti, M. G. L. Wanderley, M. G. Sajo & M. Meguro in *CFCR 7678* (holotype, SPF; isotypes, BHCB, K, MBM, MO, SP, US). Figures 1A–I, 3C–E.

Ab omnibus speciebus familiae tepalis externis auriculatis optime distincta. Inter affines hypanthio capsulaque sphaeroideis vel obloideis diagnoscitur.

Solitary, dracenoid plants, 1.5–3.5 m tall. Stems much-branched, to 20 cm diam. at base and 1.5–2.8 cm at apex. Leaves spirotristichous, straight; leaf sheaths brown; leaf lamina plane, 14–33 cm × 8–13 mm, linear-triangular, glabrous, soon deciduous, the margins serrate. Flowers 1 to 3, biseriate with petaloid perianth; peduncles 5–13 cm long, with glandular emergences toward apex; hypanthium 1.2–1.5 cm long, 1.0–1.3 cm diam., spheroid or obloid, trigonous, glabrous except for few small glandular emergences at base and apex. Tepals ca. 5 × 2.5 cm, elliptic-lanceolate, violet, glabrous, the outer ones auriculate, the auricles 1.0–1.8 × 0.7–1.5 cm, obscuring the hypanthium. Stamens 36, with purple lacerate appendages, filaments 0.7–1.0 cm long, violet, anthers ca. 1.5 cm long, yellow; style 3.5–4.0 cm long, violet, stigma 3–5 mm diam., trilobate, yellow. Capsule 1.8–2.0 cm long, 1.8–2.0 cm diam., dehiscence by apical slits on the loculi. *Leaf anatomy* (Fig. 3C–E). Lamina dorsiventral. Trichomes absent but some emergences present (Fig. 3C, arrow). Cuticle thickened on both surfaces. Abaxial furrows about one-half thickness of lamina, papillate. Stomata confined to deep blade furrows, tetracytic. Adaxial epidermis 2–3-seriate, with fiber strands separated by non-thickened cells; abaxial epidermis 1–2-seriate, with fibers. Aquiferous 1-seriate hypodermis present on both surfaces, but less developed abaxially, extending to furrows as a bridge of bulliform cells. Palisade mesophyll 3–4 cell layers thick, abaxially merging with spongy parenchyma. Fibro-vascular bundle surrounded by endodermis as leaf-bundle sheaths. Three passage cells of endodermis flanking the xylem with thickened walls facing the transfusion tracheids (Fig. 3E). Endodermis extending adaxially and abaxially to hypodermis and involving pericycle fibers on both sides of bundles. Phloem strands 2, protophloem separated by parenchymatous cells (Fig. 3E, arrow). Metaxylem with two lateral extensions, the transfusion tracheids.

Vellozia auriculata is found in the Ambrósio and Bocaina Ranges, dividing the Rio Jequitinhonha and Rio Doce basins, within the municipalities of Rio Vermelho and Itamarandiba, Minas Gerais. The new species is locally abundant, and in the Ambrósio Range is a significant floristic feature (Meguro et al., 1994; Pirani et al., 1994). It appears to be endemic to that region. Its vegetative reproduction is an obvious feature in this Minas Gerais landscape. Very tall plants (to 2 m) eventually spread their branches on the ground; these branch apices then become erect with adventitious roots developing. These self-sufficient branches eventually detach from the mother plant, and it is common to find young individuals, generated by this process, surrounding an old or already dead plant (Fig. 1A). This same phenomenon was also observed by Morawetz (1983) for *Vellozia* cf. *glochidea* Pohl (probably *V. dasypus* Seubert) in the Itapoã restinga, Bahia, and by Mello-Silva (1991) for *V. abietina* Martius, *V. maxillarioides* L. B. Smith, *V. minima* Pohl, and *V. scoparia* Goethart & Henrard, in Minas Gerais, and in a much more specialized way in *V. prolifera* Mello-Silva, from Grão-Mogol, Minas Gerais. *Vellozia auriculata* differs from all similar species by its auriculate tepals and by the spheroid to obloid hypanthium and fruit. These auricles of the outer tepals occur nowhere else among the Velloziaceae. However, their adaptative significance, if one exists, is obscure.

Paratypes. BRAZIL. **Minas Gerais**: Mun. Itamarandiba, Penha de França, elev. 1040 m, 11 Mar. 1995 (st), *S. Splet 865* (SPF, UB not seen); Mun. Rio Vermelho, Pedra Menina, Serra do Ambrósio, Fazenda Várzea do Anjo, Morro do Ambrósio, 15 July 1984 (fr), M. G. L. Wanderley, E. Varanda, A. Furlan. A. M. Giulietti & R. M. Harley in *CFCR 4507* (K not seen, SPF, U); Espigão do Meio, 13 Oct. 1984 (fr), R. Mello-Silva, J. R. Pirani, E. M. Isejima & M. Meguro in *CFCR 5464* (F, SPF, UB); 830 m alt., 8 Sep. 1986 (fr), N. L. Menezes, R. Mello-Silva, T. B. Cavalcanti, I. Cordeiro & J. C. C. Gonçalves in *CFCR 10227* (CTES, G, SP, SPF), 10 June 1991 (fl), *R. Mello-Silva, M. L. F. Salatino, A. Salatino & P. Affonso 413* (SPF); Morro da Virada do Mato Virgem, 31 July 1985 (fr), R. Mello-Silva, J. R. Pirani & M. Meguro in *CFCR 7837* (NY, SPF, UEC).

Vellozia gigantea N. L. Menezes & Mello-Silva, sp. nov. TYPE: Brazil. Minas Gerais: Santana do Riacho, Parque Nacional da Serra do Cipó, próximo à sede do IBAMA do Alto do Palácio, 24 Mar. 1989 (fl, fr), R. Mello-Silva, J. R. Pirani & M. Meguro in *CFSC 11319* (holotype, SPF; isotypes, K, MBM, MO). Figures 2A–E, 3A, B.

Ab omnibus speciebus familiae habitu giganteo optime distincta. Affinis est *V. glabrae* a qua foliis imbricatioribus

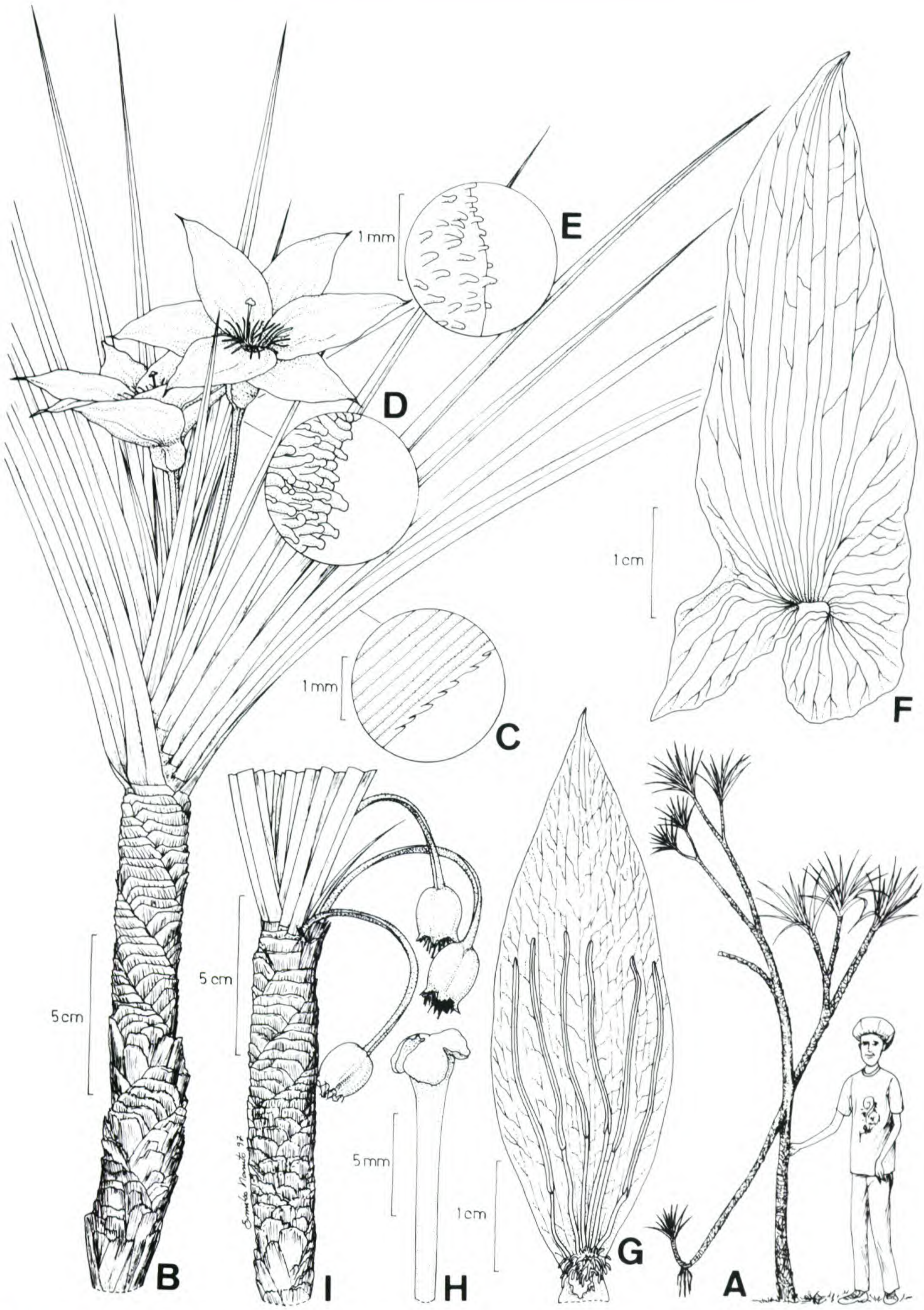

Figure 1. *Vellozia auriculata* Mello-Silva & N. L. Menezes. —A. Habit. —B. Flowering shoot. —C. Leaf margin. —D. Glandular emergences on pedicel. —E. Glandular emergences on hypanthium. —F. Outer tepal, abaxial surface. —G. Inner petal, adaxial surface, with stamens and lacerate appendages. —H. Style apex and trilobate stigma. —I. Fruiting shoot. A, from Meguro et al. (1994). B–H, Menezes in *CFCR 7678*. I, Mello-Silva in *CFCR 5464*.

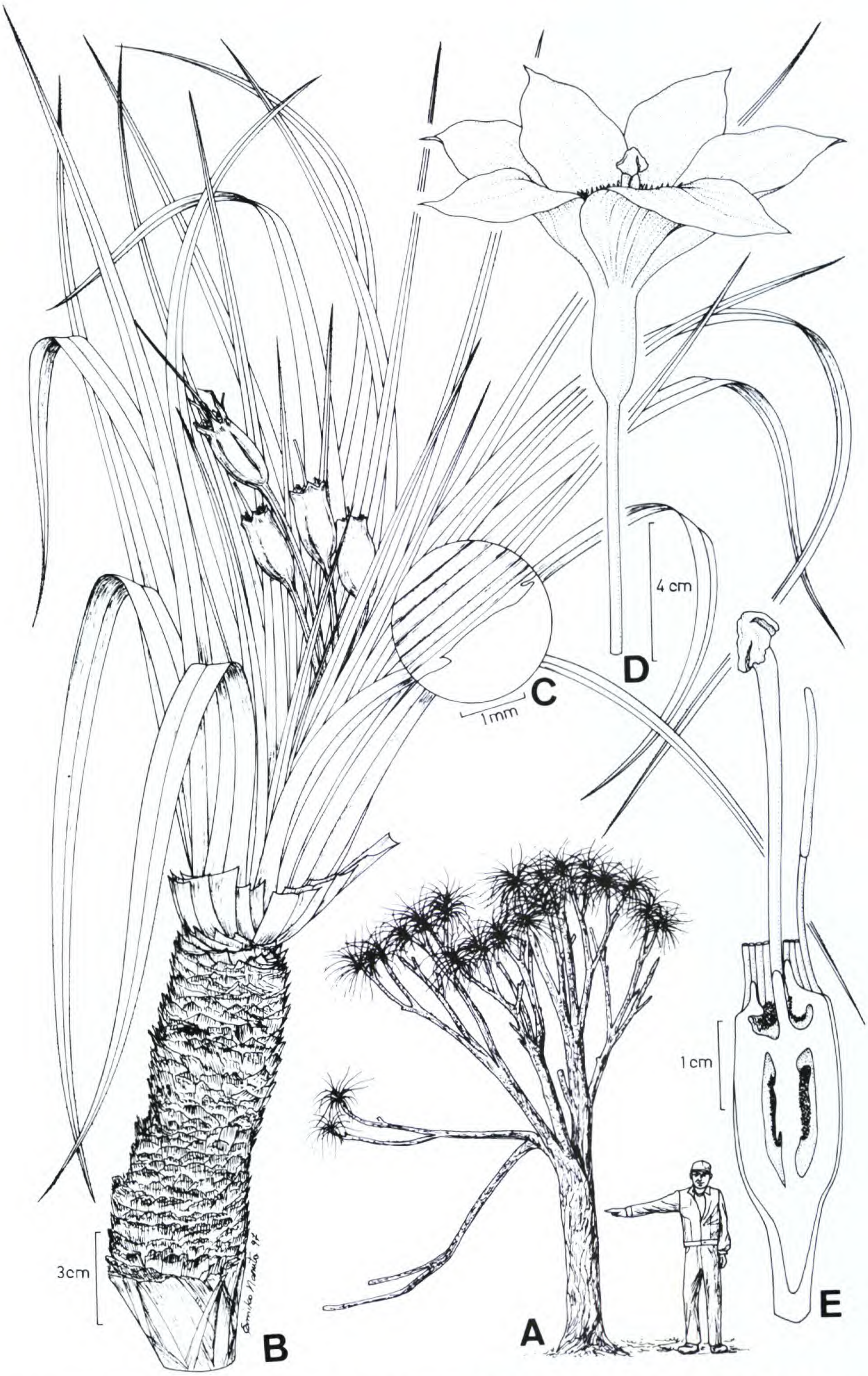

Figure 2. *Vellozia gigantea* N. L. Menezes & Mello-Silva. —A. Habit. —B. Fruiting shoot. —C. Leaf margin. —D. Flower. —E. Longitudinal fertile section showing hypanthium, axile placentation, and two of the three locules typical of the family; an entire stamen and lacerate appendages, style and stigma; tepals removed. A, from a photograph by Mello-Silva. B, E, Mello-Silva in *CFSC 11319*. C, *Menezes 1327*. D, *Pereira 998*.

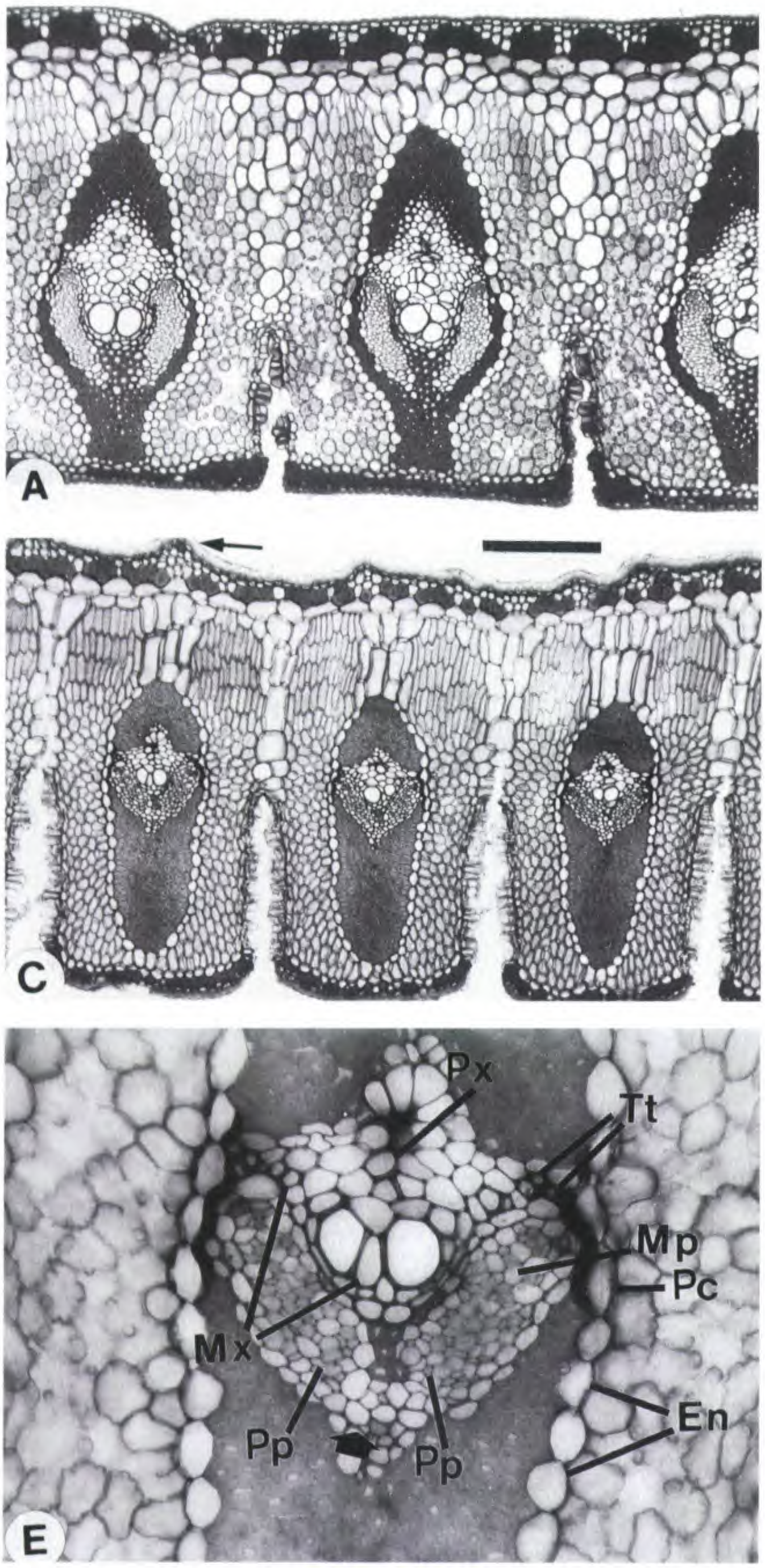

Figure 3. Cross section of median region of lamina. —A, B. *Vellozia gigantea*, from *Menezes 1327*. —C–E. *Vellozia auriculata*, from Menezes in *CFCR 7678*. —En. Endodermis. —Mp. Metaxylem. —Pc. Passage cell. —Pp. Protophloem. —Px. Protoxylem. —St. Stomata. —Tt. Transfusion tracheids. —C, arrow, indicating emergence. —E, arrow, indicating parenchyma cells. Scale bar = 200 μm (A, C), 100 μm (B, D), 50 μm (E).

vaginae foliorum apicibus cinereis oblique truncatisque differt.

Solitary, dracenoid plant, 1.5–6 m tall. Stem much branched, to 60 cm diam. at base and 3–5 cm at the apex. Leaves spirotristichous, arcuate; leaf sheaths brown, cinereous toward the apex; leaf lamina 13–45 × 0.8–1.5 cm, linear-triangular, glabrous, soon deciduous, the margins serrate. Flowers 1 to 4; peduncles smooth, 9–25 cm long, glabrous; hypanthium smooth, 2–3 cm long, 0.8–1 cm diam., cylindric-trigonous,

glabrous. Tepals 6–9 × 1–1.5 cm, narrowly elliptic, violet, glabrous. Stamens 36, with purple lacerate appendages basally, filaments 5–8 mm long, violet, anthers 2.5–3.0 cm long, yellow; style 4–5 cm long, whitish, stigma ca. 6 mm diam., trilobate, yellow. Capsules 2.5–3.5 cm long, 1.2–1.8 cm diam., dehiscence by large apical slits on the loculi. *Leaf anatomy* (Fig. 3A, B). Similar to *Vellozia auriculata* except as noted. Trichomes and emergences absent. Abaxial furrows only about one-third thickness of lamina, papillate. Adaxial epidermis 3–4-seriate, with fiber strands separated by non-thickened cells; abaxial epidermis 1–2-seriate, 4-seriate at entrances of furrows, with fibers. Aquiferous 2-seriate adaxial hypodermis extending to furrows as bulliform cells; abaxial hypodermis only 1-seriate. Palisade mesophyll 4–5 cell layers thick. Phloem strands 2, protophloem separated by fibers.

Vellozia gigantea appears to be extremely rare, much more so than *V. auriculata*. There is only one known population, within the Cipó Range National Reserve, in Minas Gerais. Individuals up to 6 m tall inhabit a sandstone outcrop of ca. 20,000 m^2 on the northwestern edge of the park, thus forming a unique landscape. These plants do not regularly flower, and the production of new individuals appears to be limited. Although the plants are protected by the Park limits, the frequent visiting of tourists threatens this population. *Vellozia glabra*, found in the Serra do Cipó and in the Diamantina plateau, is the species most similar to *V. gigantea*. Both possess smooth, oblong hypanthia and long, arching leaves. Other related species differ with more or less glandular hypanthia and more or less straight leaves. *Vellozia gigantea* can be distinguished from *V. glabra* by its leaf arrangement, which is more imbricate; its leaf sheaths are matte but apically cinereous. *Vellozia glabra* has less imbricate leaves, and its leaf sheaths are lustrous brown throughout. Given its large stature (to 6 m), mature individuals of *Vellozia gigantea* are unlikely to be confused with any of its smaller relatives.

Paratypes. BRAZIL. **Minas Gerais:** Mun. Santana do Riacho, Serra do Cipó, entroncamento da estrada Conceição do Mato Dentro–Morro do Pilar, 27 Apr. 1978 (fl, fr), *G. Martinelli 4370* (RB, SPF); Parque Estadual da Serra do Cipó, 18 Dez. 1979 (fl), *N. L. Menezes, J. Semir, M. G. Sajo, M. C. H. Mamede, R. Altikes, M. C. E. Amaral & M. T. U. Rodrigues 870* (SPF, US), 29 Jun. 1988 (fr), I. Cordeiro, S. Romaniuc Neto, M. G. L. Wanderley & E. L. M. Catharino in *CFSC 11187* (SP, SPF), 5 Jan. 1993 (fl, fr), *M. Lucca et al. 74* (BHCB); elev. 1400 m, 5 Jan. 1993 (fl), *M. Lucca et al. 76* (BHCB), 8 Mar. 1993 (fl), *M. Pereira & M. Lucca 998* (BHCB), 1 May 1993 (fl, fr), J. R. Pirani, A. M. Giulietti & F. Barros in *CFSC 13048* (SPF), 13 Apr. 1994 (fl, fr), *N. L. Menezes 1327* (SPF), 11 Jan. 1999 (fl, fr), *R. C. Forzza, S. Buzato & A. Christianini 1076* (SPF), 25 Jan. 1999 (fr), *R. C. Forzza, S. Buzato & A. Christianini 1082* (SPF).

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Una Nueva Combinación en *Festuca* (Poaceae)

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RESUMEN. Se da a conocer una nueva combinación para una especie sudamericana originalmente descripta bajo *Poa*: *Festuca nigriflora* (Hitchcock) Negritto & Anton (Poaceae). El material típico es descripto e ilustrado.

ABSTRACT. A new combination is made for a South American species originally described under *Poa*: *Festuca nigriflora* (Hitchcock) Negritto & Anton (Poaceae). The typical material is described and illustrated.

Poa L. y *Festuca* L. son géneros muy afines cuya independencia se sostiene desde antiguo sobre la base de unos pocos caracteres: lemmas aquilladas y cariopsis con hilo oval en *Poa*, lemmas redondeadas en el dorso e hilo linear en *Festuca*. A ellos se agrega la versatilidad reproductiva que se manifiesta en *Poa*, ante la casi uniformidad de *Festuca* en estos aspectos.

Por tratarse de taxones numerosos, ambos cuentan con unas 450–500 especies, las excepciones son frecuentes; en tales casos y ante límites intergenéricos imprecisos, las especies han sido asignadas sin un análisis exhaustivo a uno u otro género, lo que ha resultado en transferencias y/o sinonimias; de hecho, sólo en el *Index to Grass Species* (Chase & Niles, 1962) aparecen 35 taxones descriptos originalmente en *Festuca* y que fueron, en un tiempo u otro, transferidos a *Poa*; un ejemplo reciente lo constituye la propuesta de Laegaard (1998) cuando propone *Festuca vaginalis* (Bentham) Laegaard, basándose en *Poa vaginalis* Bentham. Por otra parte, en el *Catálogo de la Familia Poaceae en la República Argentina* (Zuloaga et al., 1994), puede constatarse la existencia de unas diez sinonimias y cinco de las transferencias citadas.

El estudio de los ejemplares tipos y del material adicional que se cita más abajo, permitió elaborar la siguiente descripción:

Festuca nigriflora (Hitchcock) Negritto & Anton, comb. nov. Basónimo: *Poa nigriflora* Hitchcock, Contr. U. S. Natl. Herb. 24: 330. 1927. TIPO: Perú. On rocky lake shore, forming tough clumps, at an altitude of 4200 m, at Huaron, 12 June 1922, *Macbride & Featherstone 1135* (holótipo, US no visto; fragmento del holótipo, BAA; isótipo, F). Figura 1A–I.

Plantas perennes, monoclinas, cespitosas, de 40–50 cm de alto; cañas erguidas, 2-nodes; entrenudos largos, el superior ca. 15 cm de long. Láminas de 10–15 cm de long. por 2.5 mm de lat., involutas, ascendentes, coriáceas, algo rígidas, glabras en su cara abaxial y pilosas en la adaxial, ápice agudo a subagudo. Lígulas truncadas, de 0.5–1 mm de long., borde superior ciliado. Vainas de 7–15 cm de long. por 5.5 mm de lat., glabras. Panojas exertas, angostas, elípticas, densas, de 9–14 cm de long. por ca. 1 cm de lat., con ramas adpresas; ramas basales 2, de hasta 4.5–5 cm de long., generalmente desprovistas de espiguillas en la 1/2 inferior. Eje, ramas y pedicelos de la panoja angulosos y ligeramente escabriúsculos. Espiguillas subcoriáceas, generalmente 2-floras, de 5.5 mm long. por ca. 2 mm lat., raro 3-floras y alcanzando hasta 8 mm long. Glumas obtusas, algo aquilladas, desiguales, coriáceas, ápice finamente ciliado, la inferior de 2.5 mm long. por ca. 0.7 mm de semilat., 1–3-nervia, la superior obtusa, de 3–3.5 mm long. por ca. 1 mm lat., 3-nervia. Lemmas negruzcas, subcoriáceas, algo redondeadas, obtusiúsculas, de 4–5.5 mm long. por 1.2 mm de semilat., nervios inconspicuos, glabras o algo escabriúsculas en la mitad superior. Páleas subcoriáceas, mayores que las lemmas o de la misma longitud, de (4.5) 5 (5.5) mm long. por 0.8 mm de lat., escabriúsculas en la mitad superior sobre las quillas y entre ellas. Flores perfectas, anteras 3, de 2.5 mm de long. Cariopsis de 2.3–2.7 mm de long., comprimidas dorsiventralmente, con surco dorsal e hilo linear tan largo como el fruto.

Material examinado. PERÚ. **Dpto. Junín:** Huarón, shady and somewhat moist crevice in rocky lakeshore, *Asplund 11800* (K). Prov. Yauli: Antajascha, entre Casapalca y Corpacancha, *Tovar 6384* (USM).

Los materiales adicionales analizados han permitido ampliar al área de distribución de la especie, la que, al tiempo de su descripción, estaba restringida a la localidad del tipo. Crece exclusivamente en los Altos Andes del Perú, entre los 4200–4600 m, en la estepa graminosa.

Tovar publicó en 1972 una revisión de las especies peruanas del género *Festuca*; allí reconoce

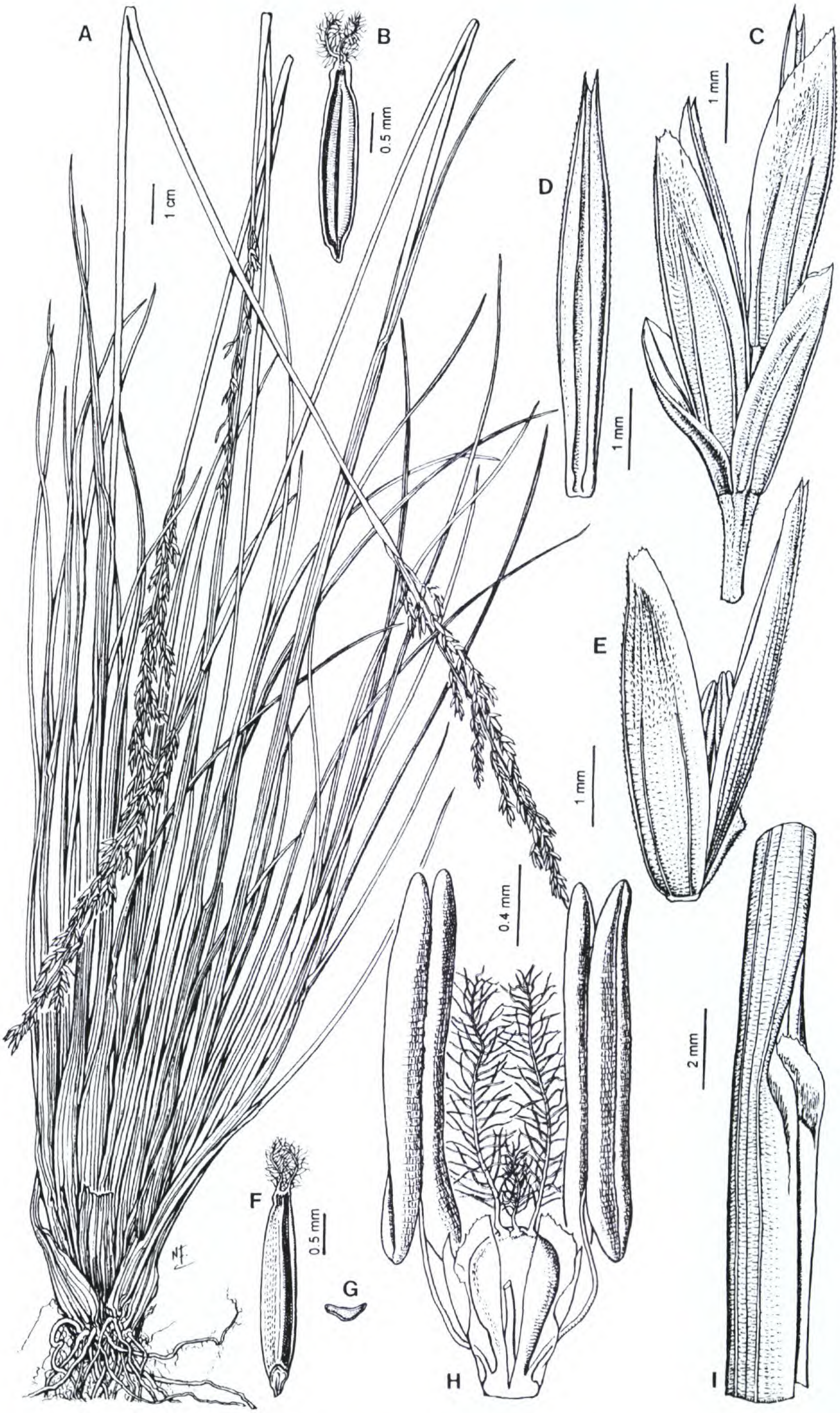

Figura 1. *Festuca nigriflora* (Hitchcock) Negritto & Anton (*Macbride & Featherstone 1135*, F). —A. Hábito. —B, F, G. Cariopsis, vista hilar, escutelar y transcorte respectivamente. —D. Pálea. —C. Espiguilla. —E. Antecio basal, nótese la lemma más corta que la pálea. —H. Flor. —I. Lígula. Dibujó Nidia Flury.

37 entidades, en su mayoría nativas de la Cordillera de los Andes. Entre ellas, la que resulta más afín a *F. nigriflora* es *F. densiflora* Tovar, especie que sólo se conoce de la localidad tipo (pajonal de puna de la región del Cuzco, a 4500 m). La mayor diferencia entre ellas la constituye la pigmentación de las lemmas y en menor medida de las glumas, la que les confiere a las panojas de *F. nigriflora* su característica coloración negruzca. Otras diferencias se resumen en la siguiente clave:

1a. Panojas de 9–14 cm long.; ramas basales de 4.5–5 cm long. desprovistas de espiguillas en su medio inferior; espiguillas generalmente 2-floras, de 5.5 mm (raro 3-floras y de hasta 8 mm long.); glumas obtusas; lemmas negruzcas . . *F. nigriflora*

1b. Panojas de 15–18 cm long.; ramas basales de hasta 9 cm long., floridas desde la base; espiguillas 3–4-floras, de 7.5 mm long.; glumas lanceoladas, agudas; lemmas pajizas . . . *F. densiflora*

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A New Combination in *Polygala* (Polygalaceae) for Southeast Asia

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ABSTRACT. The new varietal combination *Polygala glaucoides* L. var. *laotica* (Gagnepain) Pendry is published herein. The taxon is known from Cambodia, Laos, Vietnam, and Thailand.

During preparation of accounts of the Polygalaceae for the *Flora of Thailand* and *La Flore du Cambodge, du Laos et du Vietnam*, it has been found that a new varietal combination needs to be published.

Wight (1834), in his *Prodromus Florae Peninsulae Indiae Orientalis*, wrongly used the name *Polygala ciliata* L. for the collection *Wallich 4177* (collected by Wight in southern India). The use of the name *P. ciliata* was mistaken because that name correctly refers to a quite different taxon which had already been transferred to *Salomonia* by De Candolle (1824) as *S. ciliata* (L.) DC.

Gagnepain (1909) treated *Polygala ciliata* sensu Wight as consisting of three varieties. Variety *typica* has the syntypes *Wallich 4177* and *Thomson s.n.* from Maisor (= Mysore), Carnatic in southern India, and this taxon was later named *Polygala bolbothrix* by Dunn (1915). The other two varieties, var. *laotica* Gagnepain and var. *brachystachya* (A.W. Bennett) Gagnepain, can be ascribed to *P. glaucoides* L., but because of the misapplication of the name *P. ciliata*, it is necessary to publish a new combination. Variety *brachystachya* is referable to the element of *P. glaucoides* L. that contains the type of the name *P. glaucoides* (van der Meijden, 1988) and must therefore be called variety *glaucoides*. Variety *laotica* is published here as a new combination within *P. glaucoides*. It is distinguished from variety *glaucoides* by its indumentum: in addition to the usual short, curved hairs seen on all specimens of *P. glaucoides*, variety *laotica* possesses distinctive 1-mm-long, spreading, stiff, white hairs, which are found on the stems, leaves, inflorescences, and capsules.

There has been considerable confusion about the correct name for *P. glaucoides* and several other related species (notably *P. chinensis* L.); a full discussion and complete synonymy are found in van der Meijden's (1988) *Flora Malesiana* account.

Polygala glaucoides L. var. **glaucoides.** TYPE: *Herb. Hermann* 270, vol. 3: 24 (BM).

Polygala ciliata L. var. *brachystachya* (Blume) Gagnepain, Bull. Bot. Soc. Fr. 56: 20. 1909. TYPE: "In graminosis circa Buitenzorg," *Blume* (not seen).

Polygala glaucoides L. var. **laotica** (Gagnepain) Pendry, comb. nov. Basionym: *Polygala ciliata* L. var. *laotica* Gagnepain, Bull. Bot. Soc. Fr. 56: 19. 1909. TYPE: Cambodia. Oudon (= Oudong, Kandal), *Thorel 2066* (lectotype, designated here, P).

Additional material seen. CAMBODIA. **Kampot:** Kamchay, *Thorel s.n.* (P). **Kompong Speu:** *Poilane 17384* (P). **Siem Reap(?):** Compong-luong (= Kâmpóng Hluong), *Thorel s.n.* (P). THAILAND. **Ratchaburi:** Nawng Ke, 5 m, *Collins 1629* (ABD); Prachaup Khiri Khan: Hua Hin, *Kerr 13454* (BK, BM, L). VIETNAM. **Dong Nai:** *Pierre s.n.* (P).

KEY TO THE VARIETIES OF *POLYGALA GLAUCOIDES*

1a. Stems, leaves, petioles, and inflorescence with indumentum of short curved hairs only; capsule with only short, curled hairs on margin . . . . . *P. glaucoides* var. *glaucoides*

1b. Stems, leaves, petioles, and inflorescence with indumentum of short curved hairs and 1-mm-long, stiff, straight hairs; capsule with short, curled and long, straight hairs on margin . . . . . *P. glaucoides* var. *laotica*

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A New Species of *Poupartia* (Anacardiaceae) from Madagascar

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ABSTRACT. *Poupartia orientalis* Capuron ex A. Randrianasolo & J. S. Miller is described from Madagascar, and its distribution, habitat, and phenology are discussed. *Poupartia orientalis* is similar to *P. silvatica* H. Perrier but is distinct in its evergreen habit and subcoriaceous leaflets with fewer and less prominent tertiary veins.

Poupartia Commerson is a genus presently considered to comprise seven species restricted to Madagascar, the Mascarenes, and the Seychelles. Perrier de la Bâthie (1946) recognized five species in Madagascar, but *Poupartia caffra* (Sonder) H. Perrier was transferred to *Sclerocarya* Hochstetter by Kokwaro (1986), and *P. gummifera* Sprague, a species that occurs in Madagascar and Seychelle Islands, was transferred to *Operculicarya* H. Perrier by Capuron (1975). More recently, Friedmann (1994) accepted *P. gummifera* in his treatment of Anacardiaceae of the Seychelles over *Operculicarya gummifera* (H. Perrier) Capuron, a decision agreeing with Eggli's (1995) revision that excluded *O. gummifera* from his concept of *Operculicarya*. Three other species of *Poupartia* are endemic to the Mascarene Islands (Friedmann, 1997), bringing to seven the total number of species in this genus prior to this publication. Latin American and Asian taxa previously considered to belong to *Poupartia* have all been transferred to other genera (Hill, 1937; Metcalf, 1931; Cheng & Ming, 1980). A forthcoming revision of *Poupartia* will provide additional information about *P. gummifera* as well as a key for identifying all known species (Randrianasolo & J. S. Miller, in prep.).

During preparation of a revision of Anacardiaceae for Madagascar, it became apparent that a group of specimens collected in the northeastern and mid-eastern regions of the island represents an undescribed species. Although no specimens of male individuals were observed, study of the female flowers and fruits indicates that this undescribed species belongs to *Poupartia*.

Poupartia orientalis Capuron ex A. Randrianasolo & J. S. Miller, sp. nov. TYPE: Madagascar. Toamasina (Est): forêt sublittorale, sur sables, au Sud de Soanieran'Ivongo (P.K. 154), 27 Nov. 1962 (fl and yfr), *SF 22124 Capuron* (holotype, P; isotype, MO). Figure 1.

Arbor usque ad 15–20 m alta. Folia persistentia, alterna; foliolis 7 ad 13, oppositis vel suboppositis, terminali obovato, lateralibus inaequaliter ovatis, 3.5–9.0 cm longis, apice acuminatis, base inaequaliter obtusis, supra et infra glabratis; petiolulis 3–4 mm longis. Inflorescentia axillaris, racemosa, 5–7 cm longa; pedicellis 4–5 mm longis. Flores feminei 5-meri; lobulis corollinis reflexis, ovatis, 2.5–3.5 mm longis; stylis 5. Fructus drupaceus, late ovoideus ad subglobosum, 1.5–2 cm longus, 5-locularis, 5 operculatus.

Evergreen trees, 15–20 m tall; young twigs generally glabrous and with lenticels, rarely with sparse hairs at the tips of branches or branchlets. Leaves alternate, often clustered at the end of branches or branchlets, imparipinnately compound, 15–30 cm long; leaflets 7 to 13, opposite or subopposite, subcoriaceous, lateral leaflets asymmetrically ovate and the terminal ones obovate, 3.5–9 cm long, 1.5–4 cm wide, the apex long acuminate, the base unequally obtuse, sometimes very shortly decurrent, the margin entire and slightly revolute, the adaxial surface pubescent when young, almost glabrous when older except for a few hairs left on the midvein and on the margin at the leaflet base, abaxial surface pubescent when young, glabrous when mature, venation pinnate, generally brochidodromous but sometimes basal lateral veins reticulodromous, the midvein prominent on the lower surface, the lateral veins arcuate, very slightly prominent on the lower surface, the tertiary veins very few, not prominent, ramified and admedial, sometimes connecting two adjacent lateral veins; petiolule of terminal leaflet 5–30 mm long; petiolules of lateral leaflets 3–4 mm long, pubescent or glabrescent. Male inflorescence and flowers unknown. Female inflorescence axillary, racemose, 5–7 cm long, pubescent, sometimes glabrous; bracts very caducous, not observed. Flowers generally 5-merous, unisexual, small, ca. 3 mm long; pedicels 4–5 mm long, scabrous or pubescent; calyx lobes deltate, ca. 1 mm long and ca. 1 mm wide, pubescent, imbricate; corolla lobes reflexed at anthesis, ovate, 2.5–3.5 mm long, ca. 2 mm wide, glabrous, yellow or pale yellow, imbricate. Staminodes in 2 whorls of 5; filaments 1–1.5 mm long (episepalous ones longer than epipetalous), straight and broadened at the base, inserted basally on the outer surface of the disc, glabrous, white; anthers ovate, ca.

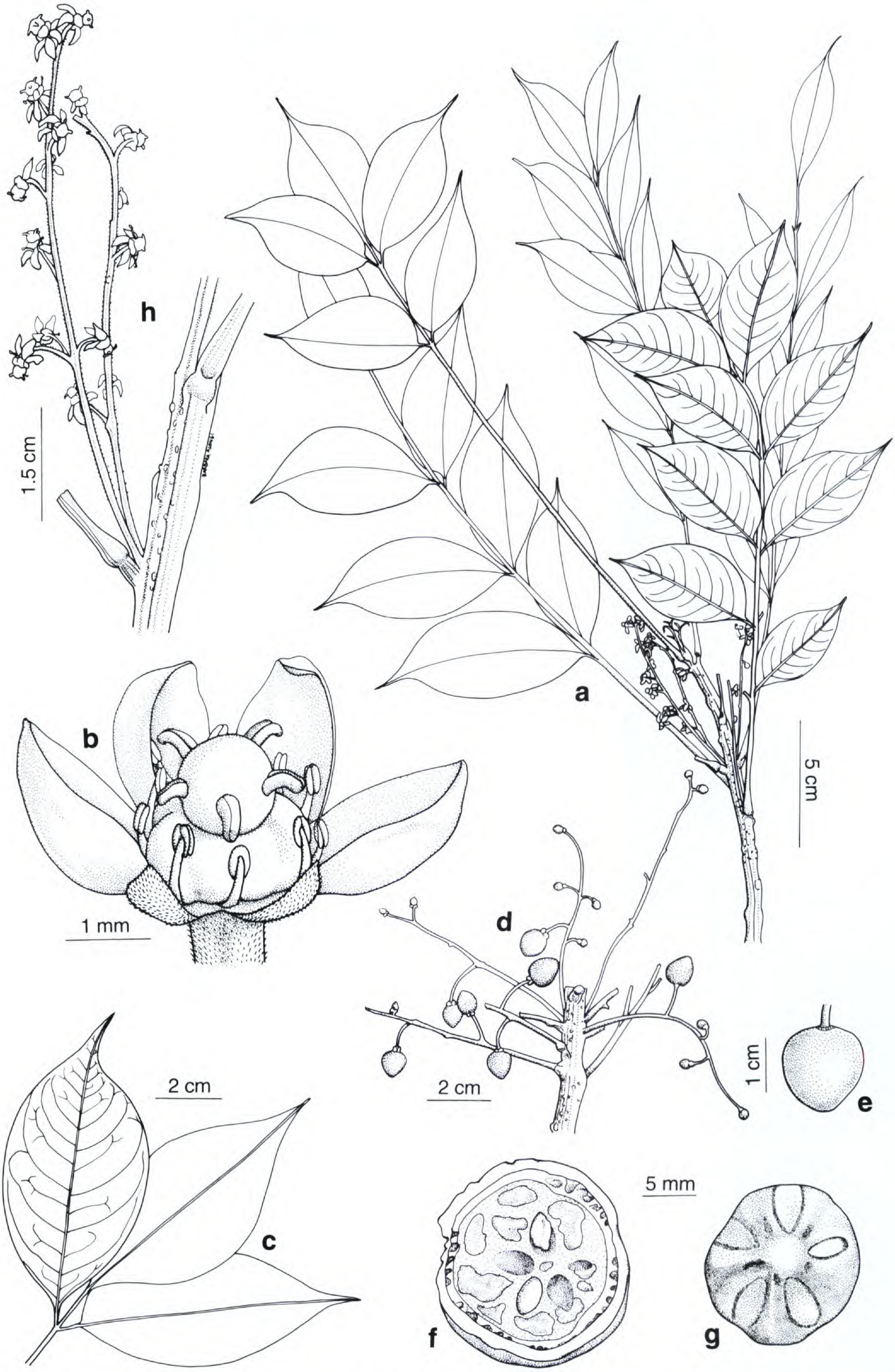

Figure 1. *Poupartia orientalis* Capuron ex A. Randrianasolo & J. S. Miller. —a. Branch with inflorescences. —b. Female flower with one petal removed. —c. Leaflet tertiary veins. —d. Infructescence. —e. Fruit. —f. Cross section of fruit. —g. Polar view of endocarp opercula. —h. Inflorescence branches. Drawn from the type.

0.3 mm long, yellow, dorsifixed, introrse, dehiscent by longitudinal slits, sterile and glabrous; disc fleshy and crater-shaped, ca. 1.5 mm diam. and ca. 0.5 mm thick; ovary very widely ovate to subglobose, 1–1.2 mm long, ca. 1 mm broad, glabrous, 5-locular of which 4 are fertile (only two ovules develop, the rest abort), ovules anatropous, with apical placentation; styles 5, distinct and short, 0.2–0.5 mm long, latero-apical, around the top, with five capitate stigmas. Fruits drupaceous, very widely ovoid to subglobose, 1.5–2 cm long, 1.3–2 cm broad, glabrous; exocarp thin, mesocarp thin and resinous, endocarp bony and thick, with 5 opercules.

Habitat and distribution. *Poupartia orientalis* is known from northeastern and mid-eastern littoral and sublittoral wet forests of Madagascar, where it grows on sandy or lateritic soils.

Phenology. This species flowers in October–November and fruits from December through June.

Vernacular name. Sakoanala, Sakoala.

Discussion. In previous publications, species of *Poupartia* have been described either as polygamodioecious (Perrier de la Bâthie, 1946) or dioecious (Friedmann, 1994, 1997). Our observations of specimens of the Malagasy species included in this genus confirm that male and female flowers are consistently found on separate individuals. In addition, the male flowers always display a reduced gynoecium with the fertile stamens, and female flowers have reduced and sterile stamens or staminodes with the functional gynoecium. Sometimes female flowers seem to have regular-sized stamens, but the anthers of these stamens lack pollen grains and are sterile and non-functional. These observations suggest that *Poupartia* species are dioecious, and although *Poupartia orientalis* is known only from specimens with female flowers, it appears not to be an exception.

Poupartia orientalis and *P. chapelieri* (Guillaumin) H. Perrier, both from eastern Madagascar, are the only two evergreen species of *Poupartia* in Madagascar. However, despite their overlapping distribution and ecological similarity, numerous characters distinguish these two species from one another. *Poupartia orientalis* has 5-locular fruits with five opercules (Fig. 1) compared with the unilocular, but bi-operculate fruits of *P. chapelieri*. In addition, *P. orientalis* has pedicels that are 4–5 mm long and petals that are 2.5–3.5 mm long, as compared to the nearly sessile and smaller flowers of *P. chapelieri*, which have pedicels 0.3–0.5 mm long and petals ca. 2 mm long. *Poupartia silvatica* H. Perrier is perhaps the species most easily confused with *P. orientalis*, as it has a similar inflorescence and flower size. However, *P. silvatica* differs in being deciduous, in having more membranaceous leaflets with more ramified, closely spaced tertiary veins, and in occurring only in the northwest and west of Madagascar.

René Capuron, a French botanist working in Madagascar, was the first person to recognize that specimens collected from northeast Madagascar probably represented a new species, and he annotated the specimens as such. However, he did not publish the name *Poupartia orientalis*; we honor him and his contributions to the Malagasy flora by accepting the name that he proposed.

Paratypes. MADAGASCAR. **Antsiranana:** Antalaha Est (Nord), table basaltique d'Ambanitazana, près d'Andrapengy (au N. d'Antalaha), 14°40′S, 50°12′E, 11 June 1967, *SF 27731 Capuron* (P). **Toamasina:** Brickaville, Ambodikijy Loharindava, 18°47′30″S, 48°40′E, 15 June 1954, *SF 10039* (P); Maroantsetra, Farankaraina, 15°25′S, 49°52′E, 12 Feb. 1955, *SF 12915* (MO, P, 2 sheets); Maroantsetra, Jardin Botanique n° 17, 15°26′S, 49°45′E, 12 Dec. 1952, *SF 7238* (P).

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Validation of Some Suprageneric Names in Magnoliophyta

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ABSTRACT. Eight superordinal and twelve ordinal names not validly published by A. L. Takhtajan in 1997 are formally validated. One name proposed by Cronquist in 1980 is validated. In addition, three names not properly validated by J. L. Reveal are included. A new family name, Exbucklandiaceae, is proposed for the illegitimate family name Bucklandiaceae. Engelhardtiaceae is validated to accommodate *Engelhardtia*, *Alfaroa*, *Alfaropsis*, and *Oreomunnea*, all distinct from the Juglandaceae s. str.

In 1997, A. L. Takhtajan proposed numerous new suprageneric names in his review of the classification of the flowering plants (Magnoliophyta). Unfortunately, a few proved not to be validly published as required by the *International Code of Botanical Nomenclature* (Greuter et al., 1994). These names are now validated with the blessing of Professor Takhtajan. Hydatellales, proposed by Cronquist in a Takhtajan (1980) paper was not validly published (Art. 32.4, 33.2); it is here validated. Two names proposed previously by Reveal (1992, 1993), Rhizophorales and Torricelliales, are also validated. Engelhardtiaceae is established as a distinct family for four genera: *Engelhardtia* Leschenault ex Blume (5 spp., northern India to China and the Philippines), *Alfaroa* Standley (7 spp., Mexico to Colombia), *Alfaropsis* Iljinskaja (1 sp., Southeast Asia), and *Oreomunnea* Oersted (2 spp., Mexico to Panama), which are distinct in pollen morphology, seed and fruit anatomy, and morphology from Juglandaceae (s. str.; Iljinskaja, 1990). Exbucklandiaceae, recently introduced by Doweld (1998), is proposed as a valid, substituted family name for the illegitimate Bucklandiaceae J. Agardh. The family is restricted to a single genus, *Exbucklandia* R. W. Brown (2 spp., eastern Asia and Malesia).

Barbeyanae Takhtajan ex Reveal & Doweld, superord. nov. TYPE: *Barbeya* Schweinfurth; Barbeyaceae Rendle, in Dyer, Fl. Trop. Afr. 6(2): 14. 1916, nom. cons.

Arbusculae; folia opposita, exstipulata; flores dioici, regulares, ebracteati v. ebracteolati; petala nulla; sepala 3–4, basi connata; stamina 6–9(–12); antherae oblongae, longitudinaliter dehiscentes; ovarium 1–3-partitum, carpella basi connata, uniovulata; ovulum anatropum, pachychalazale; fructus (capsetum) indehiscens, calycis limbo persistente; semina exalbuminosa, embryo rectus, cotyledonibus duobus planis instructus.

Trees; leaves opposite, simple, entire, pinnately veined, estipulate; inflorescences reduced cymes of short, 3-flowered dichasia, ebracteate; flowers small, wind-pollinated, dioecious, the calyx of 3–4 valvate sepals, accrescent basally, the petals none; stamens 6–9(–12), the anthers basifixed, tetrasporangiate, dehiscing longitudinally; ovary superior, 1–3-merous, the carpels typically connate basally, each with a linear style terminated by a decurrent, plumose stigma; ovules solitary, anatropous, pachychalazal; fruits an indehiscent capsetum; seeds exalbuminous; embryo straight with two flattened cotyledons.

Buxanae (Müller Argoviensis) Takhtajan ex Reveal & Doweld, superord. et stat. nov. Basionym: subtrib. Buxinae Müller Argoviensis, in DC., Prodr. 16(1): 9, 11. 1869 [Latin diagnosis in key and description in Latin]. TYPE: *Buxus* L.; Buxaceae Dumortier, Anal. Fam. Pl.: 45. 1829, nom. cons.

Casuarinanae (Lindley) Takhtajan ex Reveal & Doweld, superord. et stat. nov. Basionym: ord. Casuarinales Lindley, Nix. Pl.: 167. 1833 [Latin diagnosis in key]. TYPE: *Casuarina* Adanson; Casuarinaceae R. Brown, in Flinders, Voy. Terra Austr. 2: 571. 1814, nom. cons.

Ceratophyllanae Takhtajan ex Reveal & Doweld, superord. nov. TYPE: *Ceratophyllum* L.; Ceratophyllaceae Gray, Nat. Arr. Brit. Pl. 2: 395, 554. 1821, nom. cons.

Herbae submersae, caule ramisque teretibus, nodoso-articulatis; folia verticillata, sessilia, exstipulata, dicho- v. trichotome dissecta; flores monoici, apetali; in floribus masculis sepala libera, 9–10(–12); stamina (5–)8–18(–27), antherae biloculares, longitudinaliter dehiscentes; in floribus femineis calyx ut in masculis, ovarium unicum (folliculare), sessile; stylus terminalis, apice hinc stigmatosus; ovulum unicum, pendulum, orthotropum, unitegminatum; nuculae monospermae, coriaceae, involucro persistente stipatae, stylo persistente apiculatae; semen exalbuminosum, cotyledonibus duobus, plumula polyphylla.

Submerged aquatic herbs, rootless, monoecious; leaves simple, verticillate, essentially sessile, dichotomously divided into linear serrulate segments, estipulate, the stomata lacking; flowers minute, solitary, axillary, apetalous, actinomorphic, the calyx of 9–10(–12) bractlike sepals, hypogynous; stamens (5–)8–18(–27), spirally arranged, developing centripetally, the anthers oblong, tetrasporangiate, dehiscing longitudinally; pollen inaperturate; ovary superior, solitary (follicular), the style fairly long, the stigma decurrent ventrally; ovule solitary, pendulous, orthotropous, unitegmic; fruits a nutlet with a persistent stylodium and basal to lateral horns; seeds minute, essentially exalbuminous; embryo large, with two oblong, fleshy cotyledons, the radicle shorter than the cotyledons, the plumule well developed.

Dioscoreanae (R. Brown) Takhtajan ex Reveal & Doweld, superord. et stat. nov. Basionym: fam. Dioscoreaceae R. Brown, Prodr.: 294. 1810 [Latin description]. TYPE: *Dioscorea* L.; Dioscoreaceae R. Brown, Prodr.: 294. 1810, nom. cons.

Lactoridanae Takhtajan ex Reveal & Doweld, superord. nov. TYPE: *Lactoris* R. Philippi; Lactoridaceae Engler, in Engler & Prantl, Nat. Pflanzenfam. 3(2): 19. 1888, nom. cons.

Frutices; folia alterna, petiolata, simplicia, stipulae interpetiolares; flores in monochasia axillaria conferti, polygami-monoici, cyclici, apetali, 3-partiti; sepala 3, libera; stamina 6, dicyclica; gynoeceum apocarpum, 3-carpellare; ovula 4–8, anatropa, bitegminata; fructus (capsetum) ventrihiscens; semina albuminosa; embryo minutissimus.

Small shrubs with swollen nodes; leaves alternate, simple, distichous, with large ochrelike interpetiolar stipules united to the petioles; inflorescences an axillary monochasia; flowers polygamo-monoecious, cyclic, apetalous, trimerous, the sepals free; stamens 6 in two whorls, the anthers extrorse, dehiscing longitudinally; ovary of 3 free carpels narrowing to a stylodium bearing a short, decurrent stigma; fruits a trimerous ventrihiscent capsetum; ovules 4–8 per carpel, anatropous, bitegmic; seeds small, albuminous; embryo minute and essentially undifferentiated.

Poanae Takhtajan ex Reveal & Doweld, superord. et nom. nov. Basionym: fam. Gramineae Jussieu, Gen. Pl.: 28. 1789, nom. cons. et nom. alt. [Latin description]. TYPE: *Poa* L.; Poaceae (R. Brown) Barnhart, Bull. Torrey Bot. Club 22: 7. 1895, nom. cons.

Rhizophoranae (Persoon) Takhtajan ex Reveal & Doweld, superord. et stat. nov. Basionym: fam. Rhizophoraceae Persoon, Syn. Pl. 2: 3. 1807 [Latin description]. TYPE: *Rhizophora* L.; Rhizophoraceae R. Brown, in Flinders, Voy. Terra Austr. 2: 549. 1814, nom. cons.

Anisophylleales (Bentham & Hooker f.) Takhtajan ex Reveal & Doweld, ord. et stat. nov. Basionym: trib. Anisophylleeae Bentham & Hooker f., Gen. Pl. 1: 678, 683. 1865 [Latin diagnosis]. TYPE: *Anisophyllea* R. Brown ex Sabine; Anisophyllaceae Ridley, Fl. Malay. Penins. 1: 700. 1922.

Chrysobalanales (DC.) Takhtajan ex Reveal & Doweld, ord. et stat. nov., Basionym: trib. Chrysobalaneae DC., Prodr. 2: 525. 1825 [Latin description]. TYPE: *Chrysobalanus* L.; Chrysobalanaceae R. Brown, in Tuckey, Narr. Exped. Congo: 433. 1818, nom. cons.

Flagellariales (Meisner) Takhtajan ex Reveal & Doweld, ord. et stat. nov. Basionym: subfam. Flagellarioideae Meisner, Pl. Vasc. Gen.: Tab. Diagn. 406. 1842 [Latin diagnosis in key]. TYPE: *Flagellaria* L.; Flagellariaceae Dumortier, Anal. Fam. Pl.: 59–60. 1829, nom. cons.

Griseliniales (J. R. Forster & G. Forster ex Cunningham) Takhtajan ex Reveal & Doweld, ord. et stat. nov. Basionym: fam. Griseliniaceae J. R. Forster & G. Forster ex Cunningham, Ann. Nat. Hist. 3: 261. 1839 [Latin diagnosis]. TYPE: *Griselinia* Forst.; Griseliniaceae J. R. Forster & G. Forster ex Cunningham, Ann. Nat. Hist. 3: 261. 1839.

Hydatellales Cronquist ex Reveal & Doweld, ord. et stat. nov., based on fam. Hydatellaceae U. Hamann, New Zealand J. Bot. 14: 195. 1976 [Latin description]. TYPE: *Hydatella* Diels; Hydatellaceae U. Hamann, New Zealand J. Bot. 14: 195. 1976.

Hypoxidales (Bernhardi) Takhtajan ex Reveal & Doweld, ord. et stat. nov. Basionym: trib. Hypoxideae Bernhardi, Flora 23: 426. 1840 [Latin diagnosis]. TYPE: *Hypoxis* L.; Hypoxidaceae R. Brown, in Flinders, Voy. Terra Austr. 2: 576. 1814, nom. cons.

Lowiales Takhtajan ex Reveal & Doweld, ord. nov. TYPE: *Lowia* Scortechini; Lowiaceae Ridley, Fl. Malay. Penins. 4: 291. 1924, nom. cons.

Herbae perennes, acaules; folia basalia, disticha, petiolata; inflorescentiae e rhizomate erumpentes, cymosae, bracteosae; flos zygomorphicus; sepala 3, in tubum longum coalita; petala 3, inaequalia, petalum medianum, aliis dissimile, ex floribus exterius; stamina 5, epigyna, unilateralia; antherae basifixae, biloculares; ovarium inferum, 3-loculare, in quoque loculo ovula numerosa, 2-seriata; stylus apice trifurcatus; ovula anatropa, bitegminata; fructus capsinaris, dorsihiscens; semina albuminosa, arillo trilobato cincta.

Small to mid-sized perennial, rhizomatous herbs; leaves basal, distichous, sheathing at the base with a long well-developed petiole and lanceolate to elliptic blade, the lateral veins arching and converging apically; inflorescences a short, terminal few-flowered monochasial cyme, originated directly from the rhizome, bracteose; flowers zygomorphic and somewhat orchid-like, bisexual, the sepals 3, connate basally into a slender tube, the petals 3 with the middle one large and the others small; stamens 5, epigynous, the anthers bilocular, basifixed; pollen inaperturate; ovary inferior, 3-locular, the stigmas 3, laciniate; ovules numerous, biseriate, anatropous, bitegmic; fruits a dorsihiscent capsine (inferior capsule); seeds globose, arillate, albuminous.

Medusagynales Takhtajan ex Reveal & Doweld, ord. nov. TYPE: *Medusagyne* Baker; Medusagynaceae Engler & Gilg, Syllabus, ed. 9–10: 280. 1924, nom. cons.

Frutex ramosus; folia opposita, exstipulata, brevipetiolata; paniculae terminales, trichotomae; pedicelli graciles; bracteae bracteolaeque nullae; sepala 5; petala 5; stamina numerosa, hypogyna, antherae basifixae, biloculares, longitudinaliter dehiscentes; ovarium multiloculare (20–25), loculis angustis, styli validi, tarde decidui, stigmata capitata; ovula in quoque loculo duo, medio affixa, superposita, pendula vel adscendentia; fructus sciridialis; carpella a basi lateri-lobihiscentia, sursum divergentia, apice persistentia; semina oblonga, alata; endospermium minimum; embryo rectus.

Shrubs or small trees; leaves opposite, simple, leathery, estipulate; inflorescences a terminal panicle; flowers andromonoecious (bisexual and male only in the same inflorescence), actinomorphic, hypogynous, foetid, the sepals 5, imbricate, reflexed, basally connate, persistent; petals 5, free, imbricate and contorted in bud; stamens numerous, free, spirally arranged in 4–5 levels, the anthers basifixed, dehiscing longitudinally; ovary multilocular (20–25) with narrow locules, the robust styles free, the stigmas capitate; ovules 2 per locule, superposed, one pendulous and one erect; fruits a specialized lateri-lobihiscent (columellate) sciridium with carpels remaining united at the apex; seeds small, winged, exotegmic, the endosperm limited to a narrow band of thin-walled cells; embryo straight.

Rapateales (Meisner) Colella ex Reveal & Doweld, ord. et stat. nov. Basionym: subfam. Rapateoideae Meisner, Pl. Vasc. Gen.: Tab. Diagn. 405. 1842 [Latin diagnosis in key]. TYPE: *Rapatea* Aublet; Rapateaceae Dumortier, Anal. Fam. Pl.: 60, 62. 1829, nom. cons.

Rhizophorales (Persoon) Tieghem ex Reveal & Doweld, ord. et stat. nov. Basionym: fam. Rhizophoraceae Persoon, Syn. Pl. 2: 3. 1807 [Latin diagnosis]. TYPE: *Rhizophora* L.; Rhizophoraceae R. Brown, in Flinders, Voy. Terra Austr. 2: 549. 1814, nom. cons.

Torricelliales Takhtajan ex Reveal & Doweld, ord. et stat. nov. TYPE: *Torricellia* DC.; Torricelliaceae (Wang) H. H. Hu, Bull. Fan Mem. Inst. Biol., Bot., ser. 5, 5: 311. 1934.

Suffrutices, ramis teretibus; folia exstipulata, simplicia, petiolo basi subdilatato; panicula terminalia multiflora; flores dioici, actinomorphici; calycis tubus cum ovario connatus, limbus superus; petala 5, marginem disci epigyni inserta; stamina 5, cum petalis inserta, iisdem alterna; ovarium inferum, 3–4-carpellare, syncarpum; ovulum anatropum, unitegminatum; bacca infera (uvina) 3–4-locularis, loculis uniovulatis; semen lineare; embryo in apice endospermii copiosi brevis.

Shrubs to small trees; leaves alternate, simple, palmately veined, estipulate; inflorescences a ter-

minal panicle, dioecious; flowers small, actinomorphic, bracteolate, the male flowers with a 5-lobed calyx forming a tube connate with the ovary and 5 valvate petals, the female flowers with a minute 3–5-lobed calyx and no corolla; stamens 5, the anthers basifixed, tetrasporangiate, dehiscing longitudinally; ovary inferior, the carpels 3–4, syncarpous; ovules 1 per locule, anatropous, unitegmic; fruits an inferior berry (uvina), 3–4-locular; seeds linear; embryo small, endosperm copious.

Xanthorrhoeales Takhtajan ex Reveal & Doweld, ord. nov. TYPE: *Xanthorrhoea* Smith; Xanthorroeaceae Dumortier, Anal. Fam. Pl.: 60, 62. 1829, nom. cons.

Herbae perennes vel suffrutices; folia graminea, angusta, linearia, alternata, basi dilatata, semivaginantia; spica terminalis, typhoides; perianthium 6-partitum, dicyclicum; stamina 6, dicyclica, imo perigonio inserta; antherae basifixae v. dorsifixae, biloculares; ovarium triloculare; ovula plurima; stylus trisulcus, stigma simplex; capsula trilocularis, dorsihiscente-trivalvis; semina in loculis 1–2, compressa; embryo linearis.

Xeromorphic, rhizomatous shrubs or perennial herbs; leaves usually linear, liguliform, usually tufted, alternate, not sheathing or with a short open sheath; inflorescences a panicle, dense *Typha*-like spike, globular head, or the flowers solitary and axillary or terminal; flowers small, mostly dry and glumaceous, the perianth of 6 segments in two whorls, free or shortly connate; stamens 6, bicyclic, the inner whorl attached to the base of the inner perianth segments, the outer free or hypogynous, the anthers basifixed or dorsifixed, bilocular, dehiscing longitudinally; ovary superior, trilocular; ovules 1–2, anatropus or rarely campylotropous, bitegmic; fruits a dorsi-laterihiscent capsule; seeds globose to flattened; embryo straight, sometimes slightly curved, the endosperm copious.

Zygophyllales (Bartling) Takhtajan ex Reveal & Doweld, ord. et stat. nov. Basionym: trib. Zygophylleae Bartling, Ord. Nat. Pl.: 391. 1830 [Latin diagnosis]. TYPE: *Zygophyllum* L.; Zygophyllaceae R. Brown, in Flinders, Voy. Terra Austr. 2: 545. 1814, nom. cons.

Engelhardtiaceae Reveal & Doweld, fam. nov. TYPE: *Engelhardtia* Leschenault ex Blume. The family also includes *Alfaroa*, *Alfaropsis*, and *Oreomunnea*.

Arbores; folia alterna, abrupte pinnata, foliolis inaequilateralibus; spicae monoicae, paniculato-ramosae; in floribus masculis calycis bracteae trifidae, bracteolae bi- vel tetrafidae, stamina 5–13, antherae biloculares, loculis connectivo supra eosdem producto adnatis, longitudinaliter dehiscentibus, ovarii rudimentum nullum; in floribus femineis calyx ut floribus masculis, staminum rudimenta nulla, ovarium inferum, basi bi- vel incomplete 4-loculare, dissepimentis duplicatis; ovulum unicum, sessile, erectum, orthotropum, pachychalazale; stylus terminalis; stigmata 2–4, rarius plura, commissuralia; fructus ascadinaris cum involucro cupuliformi basi connatus, apice trialatus, indehiscens, monospermus; semen erectum, exalbuminosum; embryo bi- vel quadrilobatus.

Trees, monoecious; leaves alternate, pinnately compound, estipitate; inflorescence a spike; flowers small, the bracts 3-lobed, the bracteolae (2–)4-lobed; stamens 5–13, the anthers bilocular, dehiscing longitudinally; ovary inferior, 2- (at the base) or incompletely 4-locular; ovule solitary, sessile, erect, orthotropous, pachychalazal, the style terminal with 2–4, rarely more, stigmas, commissural; fruits an ascadina with an adherent cupuliform involucrum, trialate, indehiscent; seed solitary, exalbuminous; embryo massive, (2–)4-lobed.

Exbucklandiaceae Reveal & Doweld, nom. et fam. nov. TYPE: *Exbucklandia* R. W. Brown (= *Bucklandia* Griffith, nom. illeg., *Symingtonia* van Steenis, nom. illeg.); digeneric family (incl. *Chunia* H. T. Chang, sine *Mytilaria* Lecomte). A replacement name for Bucklandiaceae J. Agardh, Theor. Syst. Pl.: 155. 1858, nom. illeg. (Art. 18.3) [Latin description].

Arbores, ramulis abrupte terminales; folia alterna, exstipulata, petiolata; flores capitati, calyx inferne cum ovarii basi connatus; petala perigyna, numero varia; stamina 10–14, perigyna; antherae basi affixae, biloculares, longitudinaliter dehiscentes; ovarium semiinferum, biloculare; ovula in quoque loculo numerosa (5–9); styli duo; fructus capsularis, dorsihiscens, incomplete bivalvis; semina numerosa, alata, albuminosa; embryo linearis.

Trees; leaves alternate, ovate, often tricuspidate, palmately veined, estipulate, petiolate, the stipules generally large; inflorescences an aggregate of flowers in dense spikes; flowers bisexual, the calyx adherent at the base of the ovary, the petals perigynous; stamens 10–14, perigynous, the anthers basifixed, bilocular, dehiscing by valves; ovary semi-inferior, bilocular; ovules 5–9 per locule, anatropous, the styles 2; fruits a dorsihiscent capsule, incomplete bivalvate; seeds numerous, alate; embryo straight in copious endosperm.

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New Combinations in Mimosaceae

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ABSTRACT. Three new combinations, one in *Abarema* and two in *Albizia* (tribe Ingeae of the Mimosaceae), are proposed based on the study of fertile material from Central and South America. Two of these are necessary for the completion of the Mimosaceae treatment for *Flora de Nicaragua.*

In the course of preparing treatments for genera of the tribe Ingeae for the *Flora de Nicaragua*, it has been necessary to propose new combinations in the Mimosaceae. In the past 20 years, large parts of neotropical *Pithecellobium* and *Albizia* have been divided into several small genera; this fragmentation has not yet been generally accepted by foresters, agronomists, and parataxonomists. Nielsen (1981) reviewed the genera in the tribe Ingeae and stated that, historically, classification of the group has been based largely on fruit characters, leading in many cases to "pod-genera" (Nielsen, 1981: 173). Most genera were difficult to separate when only in flower, so he proposed a classification for the whole tribe (covering 20 genera), based on vegetative, floral, and carpological characters. Barneby and Grimes (1996) established a framework of seven generic alliances (containing a total of 20 genera) for mainly neotropical taxa of tribe Ingeae. A few cultivated Old World species of *Albizia* were included. Barneby and Grimes's (1996) classification was based largely on growth and branching patterns, as well as on developmental characters of vegetative and floral buds.

The first species under consideration in the present paper falls within the *Abarema* alliance of Barneby and Grimes (1996). *Abarema* contains approximately 45 species, with inflorescence, fruit, and seed characters being consistent within the genus. The species was first described as *Pithecellobium* ("*Pithecolobium*") *acreanum* Macbride (1943), but was tentatively transferred to the genus *Hydrochorea* by Barneby and Grimes (1996: 33) as "*Hydrochorea* (?) *acreana* (Macbride) Barneby & Grimes." The genus *Hydrochorea* Barneby & Grimes is mainly characterized by a lomentaceous fruit. *Hydrochorea acreana* was known to Barneby and Grimes by only two flowering specimens from the Brazilian state of Acre, and they commented (1996: 34) that "pending discovery of the fruit, its affinity cannot be assessed with finality." They went on to state, "The foliage, except for smaller petiolar nectaries, is more reminiscent of *Abarema adenophora.*"

Robleto 678 (from Nicaragua) and *Herrera 7008*, *Rivera 2350*, and *Zumbado 98* (all from Costa Rica) are fruiting specimens that all possess leaflets and relatively small petiolar nectaries that closely match those of *Pithecellobium acreanum.* Together these four collections represent two disjunct distributions of the species under discussion here.

Zumbado 98 was cited by Barneby and Grimes in their exsiccatae (1996: 283) as *Abarema macradenia* (Pittier) Barneby & Grimes, another disjunct species (Central and South America; Barneby & Grimes, 1996: 59). However, *A. macradenia* has a thick coriaceous fruit and obliquely oblong-elliptic or very obtusely rhombic leaflets, and the duplicate specimen of *Zumbado 98* at K lacks these characteristics.

Robleto 678 (BM) from Nicaragua was not cited in the Barneby and Grimes (1996) exsiccatae, but was given by them as the basis of *Abarema ricoae* Barneby & Grimes, nom. provis (1996: 110).

In their discussion under this species Barneby and Grimes stated, "In foliage the described specimen closely resembles *Balizia acreana*, and was so identified in 1988 by L. Rico (BM)." In clarification, this specimen was not identified as *Balizia acreana* but as *Abarema acreana* (Macbride) L. Rico, ined. The genus *Balizia* Barneby & Grimes was not described until 1996. Barneby and Grimes's statement that *Robleto 678* closely resembles *Balizia acreana* is an error. Presumably, the reference is to *Hydrochorea acreana.* A key difference between their provisional species *Abarema ricoae* and *Hydrochorea acreana* is peduncle length. Peduncle length of *Balizia acreana* (= *Hydrochorea acreana*) is cited as 2.5 cm (Barneby & Grimes, 1996: 110) but is elsewhere mentioned as 20–33 mm (1996: 34). Peduncle length for *Abarema ricoae* is given as ±11 cm in the description but only 11 cm in the discussion. Careful measurement of the K isotype of *Pithecellobium acreanum* (*Krukoff 5631*, a flowering specimen) re-

veals peduncles of up to 3.5 cm long. *Zumbado 98* (K), a specimen in fruit, has a peduncle about 7 cm long, and *Rivera 2350* (K), also in fruit, has a peduncle 9.5 cm long. Evidently the assumption (Barneby & Grimes, 1996: 110) that "peduncles and pedicels of other abaremas do not elongate appreciably after anthesis" is not supported. *Abarema ricoae* (as represented by *Robleto 678*) is at the upper end of peduncle length range for *Pithecellobium acreanum* (= *H. acreana*).

Also noteworthy is the fact that *Hydrochorea acreana* closely resembles *Abarema adenophora* (Ducke) Barneby & Grimes, and the two ultimately may prove to be conspecific after more fieldwork has been done. In this case, *Abarema adenophora* would have priority.

What is clear is that *Hydrochorea* (?) *acreana* is in fact an *Abarema*, and *Abarema ricoae* Barneby & Grimes nom. provis. is conspecific. The necessary combination is proposed below.

Abarema acreana (Macbride) L. Rico, comb. nov.
Basionym: *Pithecellobium* ("*Pithecolobium*") *acreanum* Macbride, Publ. Field Mus. Nat. Hist. Bot. Ser. 13(3.1): 51. 1943. *Hydrochorea* (?) *acreana* (Macbride) Barneby & Grimes, Mem. New York Bot. Gard. 74(1): 33. 1996. TYPE: Brazil. Rio Acre: on terra firma, mouth of Rio Macauhán, 24 Aug. 1933, *Krukoff 5631* (holotype, F not seen; isotype, K).

The second species under discussion in this paper was first described in 1825 as *Inga pedicellaris* DC. and has subsequently had a complicated nomenclatural history, with the epithet being transferred by Bentham in 1844 to *Pithecellobium*, by Kuntze in 1891 to *Feuillea*, by Killip ex Record in 1940 to *Samanea*, by Kleinhoonte in 1940 to *Macrosamanea*, and most recently by Barneby and Grimes in 1996 to *Balizia*. It has also been described by Vellozo in 1829 as *Mimosa terminalis*.

Balizia pedicellaris (DC.) Barneby & Grimes falls within section *Balizia* of Barneby and Grimes's small genus *Balizia* and is very closely related to (perhaps even conspecific with) *B. elegans* (Ducke) Barneby & Grimes, the only other species in section *Balizia*. The third species of *Balizia*, *B. leucocalyx* (Britton & Rose) Barneby & Grimes, was accommodated in the monotypic section *Leucosamanea* (Barneby & Grimes, 1996: 36), and they included the combination *Albizia leucocalyx* (Barneby & Grimes) L. Rico (1992) in synonymy.

In their key to the three species of *Balizia*, Barneby and Grimes (1996: 35) separated *B. pedicellaris* from *B. elegans* by calyx and corolla lengths (both longer in *B. elegans*) and by the distance between the transverse fibers of the pod mesocarp (greater in *B. elegans*). They stated that *B. pedicellaris* is widespread in South America, while *B. elegans* has a bicentric distribution in lower Amazonian Brazil and southeastern Central America (Nicaragua, Costa Rica). Zamora (1991: 132), in his treatment of the Mimosaceae for Costa Rica, gave calyx and corolla measurements for *Pithecellobium elegans* Ducke that confirm the Costa Rican material is best placed in this species. However, my measurements of all material from Nicaragua fall exactly within those of *B. pedicellaris*, and I conclude that the Nicaraguan specimens are better placed in that taxon.

When considering the genus *Albizia*, Barneby and Grimes (1996) dealt with Old World species only when they had been introduced into the Americas. This leaves an inconsistency in that several neotropical *Albizia* species have been placed in segregate genera (e.g., *Hesperalbizia*, *Pseudosamanea*, *Blanchetiodendron*) by Barneby and Grimes (1996), but most of the paleotropical species have not been dealt with. *Albizia*, when considered pantropically, remains a genus with a great diversity of floral and fruiting morphological characters. In this context, *Balizia pedicellaris* and *B. elegans* are comfortably accommodated in *Albizia* by their whitish seeds (characteristic of other *Albizia* species) and inflorescences that are similar to some Malesian species, e.g., *A. dolichadena* (Kostermans) Nielsen and *A. rosulata* (Kostermans) Nielsen. These latter two species also have fruits not dissimilar to those of *Balizia*, i.e., indehiscent or tardily dehiscent, cracking between the seeds but not through the sutures. The main fruit difference between those of *Balizia* and these two Asian taxa is that the Asian species have coiled fruits. On balance it seems wiser to adopt a broader concept of *Albizia* until the genus has been monographed across its pantropical range.

Balizia leucocalyx has already been recognized as an *Albizia* (Rico, 1992). Based on the above argument, *B. pedicellaris* and *B. elegans* are below transferred into *Albizia*, thus effectively placing the entire genus *Balizia* as a synonym of *Albizia*.

Albizia pedicellaris (DC.) L. Rico, comb. nov.
Basionym: *Inga pedicellaris* DC., Prod. 2: 441. 1825. *Pithecellobium* ("*Pithecolobium*") *pedicellare* (DC.) Bentham, in Hooker, London J. Bot. 3: 219. 1844. *Feuillea pedicellaris* (DC.) O. Kuntze, Rev. Gen. Pl. 1: 88. 1891. *Samanea pedicellaris* (DC.) Killip ex Record, Trop. Woods 63: 4. 1940. *Macrosamanea pedicellaris* (DC.) Kleinhoonte, in Pulle, Fl. Suriname 2 (2): 329. 1940. *Balizia pedicellaris* (DC.) Barneby & Grimes, Mem. New York Bot. Gard. 74(1): 37. 1996. TYPE: Cayenne (G-DC.).

Mimosa terminalis Vellozo, Fl. Flum. 11: t. 30. 1829. TYPE: "Habitat silvis maritimis."

Albizia elegans (Ducke) L. Rico, comb. nov. Basionym: *Pithecolobium elegans* Ducke, Arch. Jard. Bot. Rio Janeiro 3: 64. 1922. *Balizia elegans* (Ducke) Barneby & Grimes, Mem. New York Bot. Gard. 74(1): 40. 1996. TYPE: Brazil. Para: "Alcobaça prope fl. Tocantins," 17 July 1916, *Ducke 16271* (lectotype, designated by Barneby & Grimes (1996: 40), MG not seen; isolectotypes, BM, G, K, P, US not seen).

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Novedades Taxonómicas en *Gochnatia* (Asteraceae, Mutisieae)

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RESUMEN. En la presente nota dos de las tres variedades no típicas de la especie *Gochnatia paniculata*: *G. paniculata* var. *lanuginosa* y *G. paniculata* var. *polycephala* son consideradas sinónimos de *G. paniculata*. *Gochnatia paniculata* var. *densicephala* es elevada a la categoría de especie; la nueva combinación propuesta es: *Gochnatia densicephala* (Cabrera) Sancho.

ABSTRACT. Two non-typical varieties, *G. paniculata* var. *lanuginosa* and *G. paniculata* var. *polycephala*, are sunk back into the synonymy of *G. paniculata*, which as recognized here includes no infraspecific taxa. *Gochnatia paniculata* var. *densicephala* is raised to the rank of species; the new combination proposed is: *Gochnatia densicephala* (Cabrera) Sancho.

El género *Gochnatia* Kunth pertenece a la tribu Mutisieae e incluye alrededor de 70 especies distribuidas principalmente en centro y sudamérica; sólo dos especies tienen su área de distribución en Asia y una en el sur de los Estados Unidos. Actualmente se aceptan seis secciones dentro de *Gochnatia* (Cabrera, 1971): (1) sect. *Gochnatia*, que incluye alrededor de 43 especies centro y sudamericanas; (2) sect. *Pentaphorus*, con dos especies sudamericanas; (3) sect. *Moquiniastrum*, que incluye 20 especies sudamericanas; (4) sect. *Leucomeris*, con dos especies asiáticas; (5) sect. *Hedraiophyllum*, con 7 especies americanas; (6) sect. *Discoseris*, que incluye tres especies brasileñas.

Gochnatia paniculata, una de las especies de la sección *Moquiniastrum*, incluye hasta el presente cuatro variedades (Cabrera, 1971): var. *paniculata*, var. *densicephala*, var. *lanuginosa* y var. *polycephala*. Al tratar la sección *Moquiniastrum*, Cabrera (1971), considera al tipo de pelo y posición de la pubescencia en las caras de las hojas como caracteres diferenciales de las especies. De este modo, se forman dos grandes grupos de especies: las que presentan hojas pubescentes en ambas caras (*G. barrosii* Cabrera, *G. mollissima* (Malme) Cabrera, *G. paniculata*, *G. rusbyana* Cabrera y *G. velutina* (Bongard) Cabrera) y aquellas con hojas pubescentes sólo en la cara inferior (como las restantes especies). Sin embargo, sólo *G. paniculata* presenta tres variedades con hojas pubescentes en ambas caras y sólo una con la cara inferior pubescente. Las cuatro variedades fueron diferenciadas entre sí por la posición y densidad de la pubescencia y la longitud de los pedúnculos de los capítulos (Cabrera, 1971).

Sobre la base de lo anteriormente expuesto y como resultado de mi trabajo sobre la sección *Moquiniastrum* (Sancho, 1997, ined.) en el que he examinado más de 90 ejemplares de *G. paniculata*, considero que dos de las variedades no típicas (*polycephala* y *lanuginosa*) deben ser incluidas en la sinonimia de *G. paniculata* y que la var. *densicephala* debe elevarse a la categoría de especie. Las modificaciones propuestas son las siguientes:

Gochnatia paniculata (Lessing) Cabrera, Notas Mus. La Plata Bot., 15: 43. 1950. Basónimo: *Spadonia paniculata* Lessing, Syn. gen. Compos.: 100. 1832. *Moquinia paniculata* (Lessing) DC., Prodr. 7(1): 23. 1838. *Gochnatia paniculata* (Lessing) Cabrera var. *paniculata*, Revista Mus. La Plata, Secc. Bot. XII (66): 81. 1971. TIPO: Brasil. "Prope St. Paulo in Campo Brasiliensum," *Sellow s.n.* (holótipo, probablemente destruido, B); Brasil. São Paulo: "Casa Branca, 23-9-89," *Loefgren 16994* (neótipo, designado aquí, US!; isoneótipo, NY!). Figura 1.

Moquinia tomentosa Bongard, Mém. Acad. Imp. Sci. Saint-Pétersbourg, Sér. 6, 2: 43, 1838. TIPO: Brasil. "Brasilia. In campis collibusque siccis pr. Caeté. Sept. 1824," *Riedel 569* (holótipo, LE no visto).

Moquinia polycephala Gardner, London J. Bot. 6: 458. 1847. *Gochnatia paniculata* var. *polycephala* (Gardner) Cabrera, Revista Mus. La Plata, Secc. Bot. XII (66): 85. 1971. TIPO: Brasil. "Minas Gerais, Serro do Frio, Aug./40, a shrub 6 feet high," *Gardner 4809* (holótipo, BM no visto; isótipos, US!, K! y fotografía LP!, no vistos: G, MO, NY; fotografía Serie del Field Museum 1868 of NY!, P, S, W). El isótipo de US, tiene en su etiqueta año 1842.

Moquinia congesta Gardner, London J. Bot. 6: 459. 1847. TIPO: Brasil. "Minas Gerais, Shrub 4 to 5 feet high, July/40," *Gardner 4810* (holótipo, BM no visto; isótipos, G!, K!, US!, no vistos: NY; fotografía Serie del Field Museum 15861 of NY!, P, W). El isótipo de G, tiene en su etiqueta fecha: "Juillet, 1842."

Moquinia desertorum Gardner, London J. Bot. 6: 459.

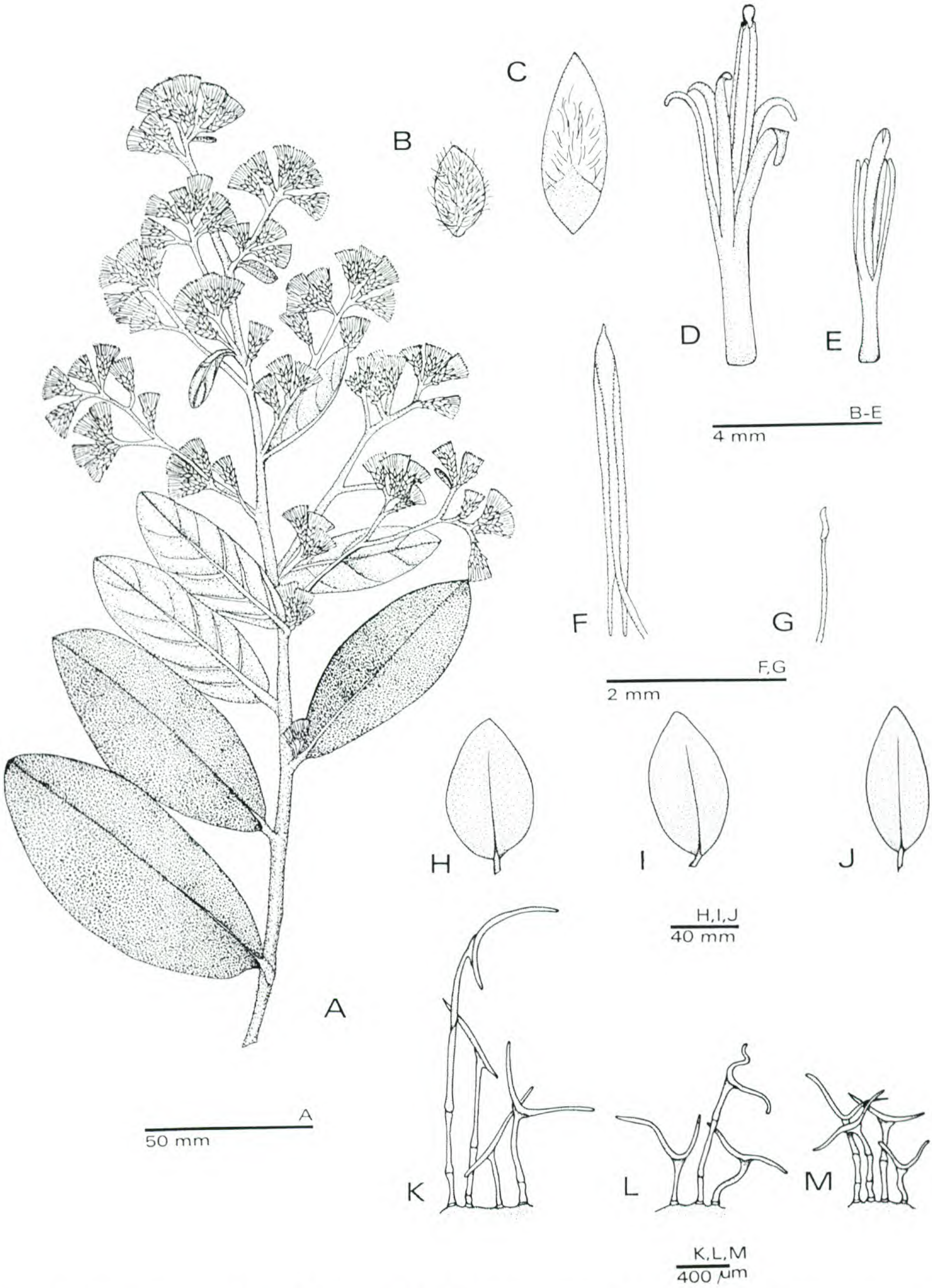

Figura 1. *Gochnatia paniculata.* —A. Rama fértil. —B. Bráctea externa del involucro. —C. Bráctea interna del involucro. —D. Flor hermafrodita. —E. Flor funcionalmente femenina. —F. Estambre de flor hermafrodita. —G. Estaminodio de flor funcionalmente femenina. —H–J. Variación de la forma de la hoja. —K–M. Pubescencia de cara superior de la lámina. (A–C, E, G de *Loefgren 16994*, US; D, F de *Regnell III 805*, S; H y K de *Brade 13550*, LP; I y L de *Loefgren 334*, S; J y M de *Dusén 17107a*, G.)

1847. TIPO: Brasil. "Minas Gerais, Between Rio San Francisco and Formigas, July 1840, a shrub 6 to 8 feet," *Gardner 4808* (holótipo, BM no visto; isótipos, F!, K! y fotografía LP!, US!, no vistos: G, GH, NY, P, S, W). El isótipo de F, tiene en su etiqueta fecha: "Juillet, 1842."

Moquinia lanuginosa Baker, en Martius, Fl. bras. 6(3): 345. 1884. *Gochnatia lanuginosa* (Baker) Cabrera, Notas Mus. La Plata, 15: 43. 1950. *Gochnatia paniculata* var. *lanuginosa* (Baker) Cabrera, Revista Mus. La Plata, Secc. Bot. XII (66): 83. 1971. TIPO: Brasil. "Goyaz, Serra de Duro, Sept. 1839, 2–3 feet high," *Gardner 3245* (lectótipo, designado por Cabrera (1971), K!). Paralectótipo, *Pohl 554* (K no visto, fotografía LP!).

La diferencia entre las variedades *paniculata* y *polycephala* estaba sustentada principalmente por las longitudes de los pedúnculos de los capítulos: sésiles o casi sésiles en la variedad *paniculata* y en gran parte pedunculados en la variedad *polycephala* (Cabrera, 1971). Si bien se han hallado ejemplares en los extremos del rango de longitud de los pedúnculos, en la mayoría de los ejemplares de las dos variedades existe superposición o son variables en su longitud de acuerdo al lugar de la panoja en que se encuentran. La variedad *lanuginosa* fue diferenciada de las restantes variedades por su densa pubescencia en toda la planta y hojas anchamente ovadas (Cabrera, 1971). Estos caracteres presentan superposición con las variedades *polycephala* y *paniculata*, de manera que es imposible la diferenciación de muchos ejemplares ya que existe continuidad en la longitud de los pedúnculos, de la pubescencia y el ancho de las hojas. La Figura 1 muestra la secuencia de aumento en el ancho de la hoja (H–J) y su correspondiente aumento en la longitud de los pelos (K–M), de manera que puede observarse la continuidad de ambos caracteres.

Observación. No he podido hallar el tipo de *Spadonia paniculata* Lessing, leg. *Sellow s.n.* Fueron consultados los herbarios B, BM, BR, F, G, GH, HAL, K, M, MO, NY, P, POM, S, SP, UPS, US, W, WU pero en ninguno de ellos se encuentra depositado ese ejemplar típico. Por otro lado tampoco el Dr. Cabrera, en su exhaustiva revisión del género *Gochnatia* (1971), pudo hallar dicho espécimen. Por estas razones he decidido neotipificar la especie *Spadonia paniculata* designando como neótipo al ejemplar *Loefgren 16994* depositado en US, que posee un isoneótipo en NY.

Ejemplares adicionales examinados. BRASIL. **Minas Gerais:** Mun. Tres Corações, *Hatschbach 29835* (MO, NY, S, US); Paraopeba, Faz. do Bebedouro, *Heringer 4028* (LP); Mun. Belo Horizonte, *Mello Barreto 4201* (F), *4207* (F); Passos, *Regnell III.805* (S); Lagoa Santa, *Warming s.n.* (S); cachoeira do campo, *Casaretto 2840* (G); Serra do Cabiara, *Duarte 3035* (NY); Serra do Barranco, *Mahelles 1717* (R); Lavras, *Pereira-ESAL 2347* (UEC); Mun. Passos, *Vichnesky 14798* (UEC); Campus UFMG, *Fernandes et Neto 065* (UEC); Lavras, Altinopolis, *Dac et al. 2878* (UEC); Lavras, *Calegeri Lopes & Vichneswki 15797* (UEC); Diamantina, *Zickel et al. 21688* (UEC); Carrancas, *Semir et al. 19577* (UEC); Massa, *Brade 13550* (LP); "environs de R. Janeiro et D'Ouro Preto," *Glaziou 15044* (K); Lavras, *Maia 167 M.* (LP); Minas, *Glaziou 19557* (K); Mun. de Gouveia, Corrego do Tigre, *Hatschbach 27016* (K, S); Serra do Lenheiro, *Valka Alves 1354* (NY). **São Paulo:** Serra da Bocaina, *Glaziou 78* (LP, R); Jardim Botanico, 5–8–1940, *Handro s.n.* (LP); Campos de Butantam, *Joly 450 ABJ* (LP); Butantam, *Hoehne 538* (NY, US); Butantam, 24–10–1918, *Hoehne s.n.* (SP); Campos da Bocaina, *Glaziou 11098* (G, R); Serra da Bocaina, *Brade 21174* (G, F, NY, S); Cotia, *Kulhmann s.n.* (SP); Atibaia, Serra do Itapatinga, *Tamandaré & Brade 967* (US); Itararé, *Dusén 9938* (S, US); Rod. Itararé-Bom. Sucesso, *Mattos 13994* (SP); São Jose dos Campos, *Loefgren 334* (S); São Jose dos Campos, *Mimura 551* (NY, SP, US); Serra da Bocaina, *Shepherd & Shepherd 12827* (UEC, US); Capital, *von Emelen 1435* (US); Mun. São Jose dos Campos, *Eiten & Mimura 3352* (US); Est. Exp. de Itararé, *Leitao Filho 879* (LP, UEC); Rio Preto, *Camargo & Marinis 8* (HAS); Perto de Mogí, *Mattos 8153* (HAS); Butantam, *Diogo 538* (R); Campos da Bocaina, *Glaziou 11098* (R); Itapeva, *Souza et al. 8705* (UEC); Riberão Preto, *Sarti 8497* (UEC); *Burchell 4769–2* (K, NY). **Paraná:** Itararé, *Dusén 9935* (US); Jaguariaiva, Fda. Cajurú, *Hatschbach 20057* (LP); Jaguariaiva, *Dusén 9571* (NY, S), *13087* (S, SI), *15105* (G, S), *15105a* (S), *17107* (G, NY, S, US), *17107a* (MO, S); Villa Velha, *Dusén 14825* (S); Rio Tibagi, *Hatschbach 14688* (LP, NY, US); Mun. Ortigueira, Pedra Branca, *Hatschbach 53307 & Silva* (MO); Mun. São Jerónimo da Serra, Fda. Nho O', *Hatschbach 24788 & Guimarães* (MO); Mun. Cerro Azul, Serra da Canha, *Hatschbach 32613* (MO, SP); Bocaiuva do Sul, Santa Ana, *Hatschbach 27084* (S). **Rio de Janeiro:** near Rio de Janeiro, *Glaziou 11098* (K) (los ejemplares *Glaziou 11098* de K, G y R tienen igual colector y número pero diferente fecha o localidad).

Gochnatia densicephala (Cabrera) Sancho, comb. et stat. nov. Basónimo: *Gochnatia paniculata* var. *densicephala* Cabrera, Revista Mus. La Plata. Secc. Bot. 12(66): 86. 1971. TIPO: "Near Rio de Janeiro, Nov. 1879," *Glaziou 11072* (holótipo, K!). Figura 2.

Los caracteres que diferencian a *Gochnatia densicephala* de *G. paniculata* son: (1) Hojas glabras en la cara superior de la hoja (sin pelos en T, "malpigiáceos," y sólo con pelos glandulares). (2) Capítulos siempre dispuestos en panojas de glomérulos mientras que en *G. paniculata* las panojas pueden ser glomeriformes, espiciformes o racemiformes.

Si bien las hojas inmaduras de *G. densicephala* presentan ocasionalmente pelos en T en ambas caras, esta condición es común a todas las hojas jóvenes de las restantes especies de la sección *Moquiniastrum* independientemente del estado adulto. Las hojas maduras de *G. densicephala* se caracterizan por ser brillantes y glabras en el haz.

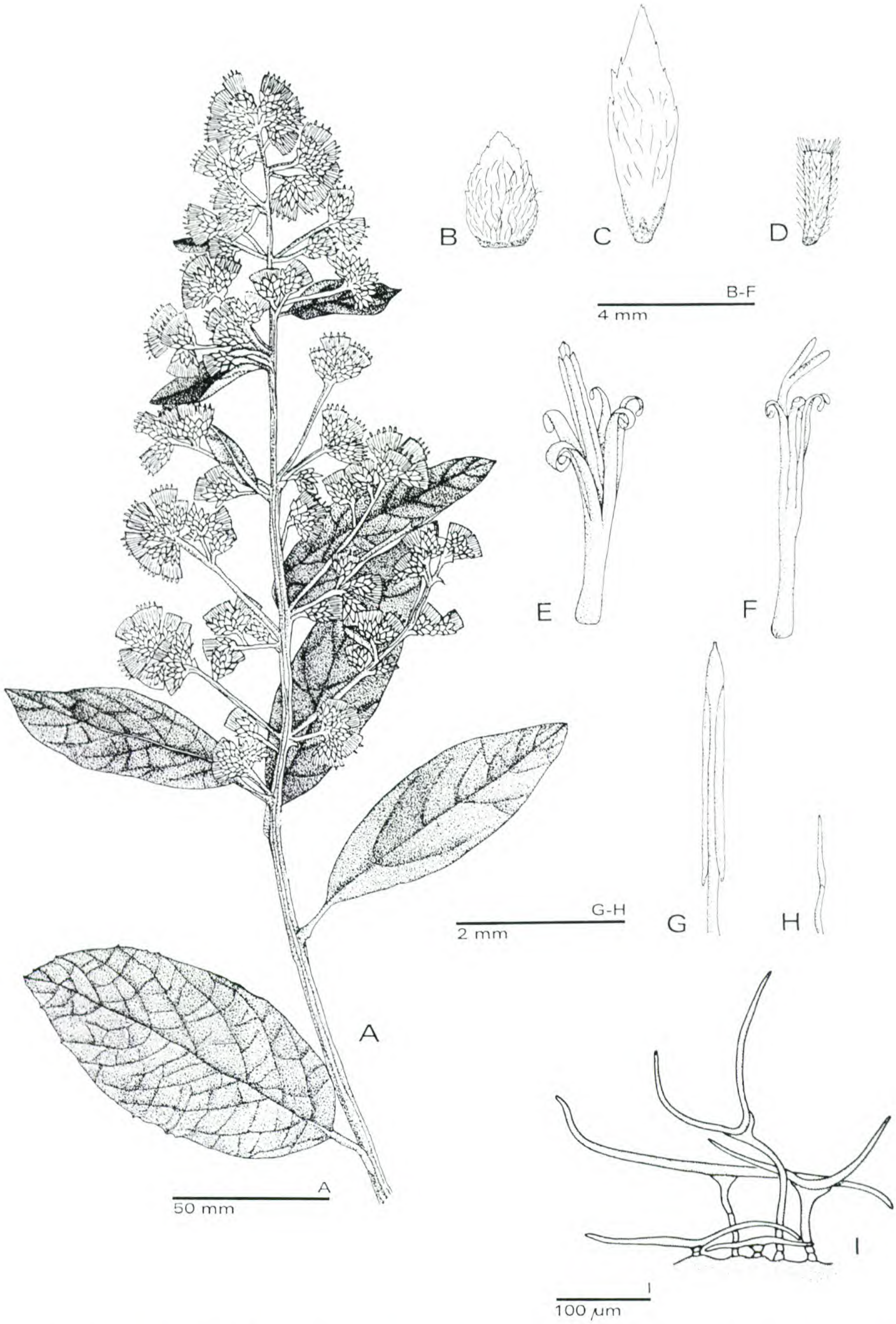

Figura 2. *Gochnatia densicephala*. —A. Rama fértil. —B. Bráctea externa del involucro. —C. Bráctea interna del involucro. —D. Aquenio de flor hermafrodita. —E. Flor hermafrodita. —F. Flor funcionalmente femenina. —G. Estambre de flor hermafrodita. —H. Estaminodio de flor funcionalmente femenina. —I. Pubescencia de cara inferior de la lámina. (A–E, G de *Leoncini 88*, LP; I de *Yamamoto 1096*, UEC; F–H de *Hoehne s.n.*, 1–6–1927, SP).

Distribución y hábitat. Brasil, en el sur del estado de Minas Gerais, Rio de Janeiro, y norte de São Paulo. Frecuente en campos del Cerrado, en morros o sierras, colectado hasta los 1100 m s.m. Su distribución coincide con parte del área de *G. paniculata* (en los estados de Minas Gerais, Rio de Janeiro y São Paulo). Esta última especie se extiende más al sur hasta el estado de Paraná.

Ejemplares adicionales examinados. BRASIL. **Minas Gerais:** Mun. Belo Horizonte, Pampulha, *Williams & Assis 7393* (LP); Poços de Caldas, Campo do Saco, *Buker & Roppa 438* (LP, SI), *453* (SI), *464* (SI); Poços de Caldas, Faz. Teixeira, *Leoncini 88* (LP, SI); 1838, *Claussen 137* (K); voyage e/1816–1821, *A. de Saint-Hilaire 1490* (K); Ouro Preto, *Damazio 1410* (LP); Manhuaçu, *Hatschbach 49391* (K, MO); Caldas, *Regnell I-213* (K); Morro das Pedras, near Belo Horizonte, *Williams & Assis 8017* (K); Poços de Caldas, Campo do Saco, *Yamamoto et al. 1010* (UEC), *1096* (UEC); Poços de Caldas, *Pereira et al. 870* (UEC); Jaboticatubas, Serra de Cipo, *Semir & Sazima 2725* (UEC); Poços de Caldas, *Leitão Filho et al. 1681-A* (UEC); Serra do Tritiba, *Silveira & Silveira 2166* (R); Pico da Bandeira, *Shepherd et al. 5771* (UEC); São Sebastião da Praia, *Sarti & Santos Filho 14418* (UEC); Campo do Saco, *Leitão Filho et al. 1126* (UEC); Ouro Preto, entre Itabirito y Belo Horizonte, *Davis & Sheperd D.59696* (UEC); Lavras, Serra da Bocaina, *Dac et al. 8231* (UEC). **São Pablo:** 25–7–1945, *Hoehne s.n.* (LP); Pico da Serra Negra, 1–6–1927, *Hoehne s.n.* (SP); Pico do Morro Pellado, perto das Thermas de Lindoya, 4–6–1927, *Hoehne s.n.* (SP); Mun. Guarulhos, *Martins & Tamashiro 11243* (UEC). **Rio de Janeiro:** Rio de Janeiro, *Glaziou 12053* (G, K); Morro da Cruz, Nova Friburgo, *Siqueira 1030 et al.* (UEC). **Sin Loc. Definida:** Villa Franca et Pr. Goyaz, *Riedel & Lund 2365* (NY, US); *Claussen s.n.* (LP).

Agradecimientos. Agradezco a Susana E. Freire, Liliana Katinas y Jorge V. Crisci por la lectura crítica del manuscrito, a Dan H. Nicolson por sus comentarios acerca de la tipificación de *Spadonia paniculata*, al Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) por el financiamiento de mis investigaciones y a los curadores de los herbarios F, G, HAS, K, LP, MO, NY, R, S, SI, SP, UEC, y US por el préstamo de los materiales estudiados.

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Typification of Two Linnaean Names in the Basellaceae

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ABSTRACT. During the writing of the treatment of Basellaceae for *Flora Mesoamericana* it became apparent that typification of the Linnaean names *Basella alba* L. and *B. lucida* L. required clarification. A note to formally fix the application of these two names is provided here.

The genus *Basella* consists of five species, four in east and southeast Africa and Madagascar, the other pantropical and widely cultivated (Sperling, 1987). The three Linnaean names for species of *Basella* are now considered conspecific, and typification of two of these names is clarified below.

In *Species Plantarum*, Linnaeus first described two species of *Basella* L., *B. rubra* L. and *B. alba* L. These two species were distinguished on a single leaf character: *Basella rubra* was described as "*Basella foliis planis*," while *Basella alba* in contrast was described as "*Basella foliis undatis*" (Linnaeus, 1753: 272). A third species, *Basella lucida* L., was described by Linnaeus in 1759, differing from the other two in having subcordate, rather than ovate, leaves and densely terminally branched, rather than simple, peduncles.

Basella rubra, *B. alba*, and *B. lucida* were first treated as a single species by Roxburgh (1832), who used the name *B. alba*. Within *B. alba* Roxburgh recognized five "varieties," based on local taxonomic knowledge, and he listed these five subgroups as two "wild sorts" and three "cultivated sorts" (Roxburgh, 1832: 275). Graham (1839) followed Roxburgh's account, but was erroneously credited by Smith (1981) as the first to combine the names under *B. alba*. Baillon (1887), on the other hand, considered *B. alba* a variety of *B. rubra*, and several authors subsequently followed that work and accepted *B. rubra* as the name for the single species. As Roxburgh (1832) was the first author to place *B. alba* and *B. rubra* in synonymy, and in doing so adopted *B. alba*, it (and not *B. rubra*) is the correct name under Article 11.5 of the *Code* (see van Steenis, 1957; Smith, 1981, and references therein; Greuter et al., 1994). Additionally, *B. alba* is the name in current use, and the types designated here are intended to maintain this usage.

Basella rubra was lectotypified by Verdcourt (1968), who selected the unpublished drawing of a fruiting plant in Herb. Hermann 5: t. 207 (lectotype, BM) that formed the basis for Linnaeus's *Flora Zeylanica* account, a choice Smith (1981) also suggested as a logical lectotype and that has been followed by Kellogg (1988). *Basella rubra* L. was accepted as the type of the genus *Basella* L. by Jarvis et al. (1993).

The types of *Basella alba* L. and *B. lucida* L. have not previously been clarified. A single synonym from Thran (Hort. Carolsruh. 11, n. 125. 1747), "*Basella flore albo, foliis & caulibus viridibus*," was cited in the original description of *B. alba*, and this has subsequently been cited as the type of *B. alba* (miscited as Thran, Hort. Carolsruh. 10, n. 100. 1747, by Verdcourt, 1968; Sperling, 1987; and Kellogg, 1988). However, the synonym in the protologue does not have a visual element and it cannot therefore serve as the type, which must be a single specimen or illustration (Greuter et al., 1994: Art. 8.1). There are no extant original elements for the name *Basella alba*. Three specimens annotated as *B. alba* exist in the Linnaean herbarium in Stockholm. However, none are annotated by Linnaeus and therefore cannot be considered original material for the name and eligible for lectotypification. A neotype is therefore required to formally fix the application of the name *Basella alba*.

In *Species Plantarum* edition 2 (1762: 390), Linnaeus added a reference to an illustration of *Basella alba* in Plukenet (1691: tab. 63, fig. 1). Plukenet (1696: 252) used the polynomial "*Mirabili Peruvianae affinis tinctoria Betaefolio scandens*" for the species and cited the illustration in van Rheede (*Hortus Malabaricus* 7, tab. 24. 1688) under that name. The plate in Plukenet clearly illustrates *Basella alba* L. as it is now circumscribed. Having cited the distribution of *Basella alba* as "Syria?" (Linnaeus, 1753: 272) in the first edition of *Species Plantarum*, Linnaeus followed Plukenet in 1762, stating that *B. alba* was from China. As possible neotypes, the Chinese specimens available were considered of rather poor quality. Therefore, the neotype selected here is a specimen with plenty of

fertile material, and detailed locality data, from Nepal.

Although *Basella lucida* L. was recognized by Moquin-Tandon (1849) as a distinct species, it has otherwise been considered a synonym of *B. alba* L. by most authors since Linnaeus. In his treatment of the three species of *Basella,* Linnaeus (1762: 391) added a note that the species were clearly very closely related: "*Affines nimium sunt hae tres species, sed constantes se servant in hortis.*" The short description of *B. lucida* (Linnaeus, 1762) fits within the current circumscription of *Basella alba,* and there is no doubt that the name should be placed in synonymy.

The nomenclature and synonymy of Linnaean names within *Basella* are as follows:

Basella alba L., Sp. Pl. 272. 1753. TYPE: Nepal. Mahakali Zone: Kanchapur District, 15 mi. W of Dhangarhi, 7 Dec. 1966, *Nicolson 2848,* (neotype, BM; isoneotype, US not seen).

Basella lucida L., Sp. Pl. (ed. 2) 391. 1762. TYPE: Taiwan. Taipeh, May 1909, *Faurie 109* (neotype, BM).

Basella rubra L., Sp. Pl. 272. 1753. TYPE: Herb. Hermann 5 t. 207 (lectotype, designated by Verdcourt (1968), BM).

Acknowledgments. I thank Steve Cafferty and Charlie Jarvis of the Linnean Plant Name Typification Project for providing nomenclatural assistance and advice with this paper.

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Two New Combinations in Apocynaceae, Asclepiadoideae from Mesoamerica

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Abstract. The combinations *Matelea fulvida* (F. Ballard) W. D. Stevens and *Dictyanthus asper* (Miller) W. D. Stevens are proposed to make them available for the forthcoming *Flora de Nicaragua*.

Matelea fulvida (F. Ballard) W. D. Stevens, comb. nov. Basionym: *Gonolobus fulvidus* F. Ballard, Bot. Mag. 163: t. 9611. 1940. Based on *Vincetoxicum grandiflorum* Standley, Publ. Carnegie Inst. Wash. 461: 83. 1935. *Matelea grandiflora* (Standley) Woodson, Ann. Missouri Bot. Gard. 28: 235. 1941. Not *Vincetoxicum grandiflorum* (R. Brown) Kuntze, Revis. Gen. Pl. 2: 424. 1891. TYPE: Belize. Machaca: 12 Aug. 1933, *Schipp S575* (holotype, F; isotypes, MO, UC, US).

Vincetoxicum grandiflorum Standley is a later homonym of *Vincetoxicum grandiflorum* (R. Brown) Kuntze. The replacement name *Gonolobus fulvidus* F. Ballard predates by one year Woodson's "comb. nov.," which is effectively also a replacement name. Therefore, Ballard's epithet must be used for this Mesoamerican species.

Dictyanthus asper (Miller) W. D. Stevens, comb. nov. Basionym: *Cynanchum asperum* Miller, Gard. Dict. (ed. 8): n. 6. 1768. *Matelea aspera* (Miller) W. D. Stevens, Phytologia 32: 396. 1975. TYPE: Mexico. Veracruz: "E. Vera Cruz," 1730, *Houstoun s.n.* (holotype, BM).

Ongoing studies of the large and complex genus *Matelea* have demonstrated that some elements, including *Dictyanthus*, deserve generic status. Full synonymy for this species, when treated as *Matelea*, can be found in Stevens (1975).

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Novon 9: 564. 1999.

A New *Marsdenia* (Apocynaceae, Asclepiadoideae) from Baja California

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ABSTRACT. *Marsdenia carterae*, a new species of Apocynaceae (Asclepiadoideae, Marsdenieae) from Baja California Sur, Mexico, is described and illustrated. This is the first North American species of *Marsdenia* with verticillate leaves and is also notable in lacking a developed corona and for its non-twining habit.

Marsdenia carterae W. D. Stevens & Juárez-Jaimes, sp. nov. TYPE: Mexico. Baja California Sur: eastern escarpment of Cerro Mechudo between Portezuelo de San Antonio and La Sabanilla, Sierra de la Giganta, 675 m, 24°49′N, 110°44′W, occasional on cliffs and talus, 4 Nov. 1971, *R. Moran 18990* (holotype, UC; isotype, MO). Figure 1.

Distribution map and additional images can be found in W³TROPICOS (http://mobot.mobot.org/Pick/Search/pick.html).

A speciebus ceteris *Marsdeniae* regionis foliis verticillatis habitu haud volubili corona obsoleta distinguenda.

Shrub to 1.5 m tall and 2.5 m wide, branches decumbent or pendent, stems with thick, dark, corky bark on older wood, bark thinner and whitish on younger wood, branchlets roughened by raised leaf scars, densely pubescent with appressed, ± curly, multicellular hairs to ca. 0.15 mm long, internodes 1–5(–25) mm long, ribbed except when still herbaceous; latex white; roots unknown. Leaves 3, rarely 1 or 2, per node, without pseudostipules but with 1–3 colleters in each stipular area, blades 5–8.5 cm long, 4–8 mm wide, very narrowly lanceolate to lorate or linear, apex acute to rounded or minutely mucronate, base acute, minutely pubescent when young, glabrescent except hairs ± persistent along midrib of both sides, midrib prominent below, sulcate above, especially near petiole, venation pinnate, lateral veins obscure, ca. 7–13 pairs, middle veins arising ca. 55° to midrib, margin thickened and ± revolute, colleters 0–3, at adaxial base of blade; petiole 4–6 mm long, with indumentum of stem. Inflorescence extra-axillary, 1 per node and mostly not on adjacent nodes, cymose, congested-racemiform, or congested-paniculiform, sometimes bearing a fully formed leaf opposite the first flower or branch, 5–15-flowered, with indumentum of stem, peduncle 2–5 mm long, pedicel 3–4 mm long, bracts to 2.5 mm long, 1.1 mm wide, lanceolate; calyx divided to base, with 1–2 colleters below each sinus within, lobes 2.2–2.5 mm long, 0.9–1.4 mm wide, ovate or elliptic, with rounded tips, green with scarious margins, pubescent outside, glabrous inside; corolla rotate with ascending lobes, aestivation narrowly imbricate and dextrorse, glabrous outside, glabrous inside except throat densely barbate with stiff, white, unicellular hairs to ca. 0.5 mm long, these spreading at sinuses and retrorse between, cream-white, tube 1.2–1.4 mm long, lobes 2.3–3.1 mm long, 1.5–2.2 mm wide, elliptic with obliquely rounded tips; gynostegium ca. 2.2 mm tall, stipe ca. 1.7 mm long, corona obsolete, anthers rectangular, ca. 1.0 mm long, 1.5 mm wide, terminal appendages ovate, ca. 0.8 mm long, 0.6 mm wide, ± erect and appressed to style apex, wings straight, parallel, ca. 0.5 mm long, 0.3 mm wide; corpusculum ca. 0.25 mm long, 0.08 mm wide, linear, dark red-brown, translator ca. 0.08 mm long, translucent and unwinged, pollinia erect, ca. 0.25 mm long, 0.15 mm wide, obovate, pale yellow; style apex conical, smooth, shallowly 2-lobed at apex, ca. 0.4 mm wide. Follicles single or occasionally paired, divergent when paired, fusiform-attenuate to napiform, somewhat asymmetrical, smooth, 7–12 cm long, 1.3–1.8 cm wide, densely tomentose, follicle wall ca. 0.5 mm thick, herbaceous; seeds obovate, flat, ca. 11 mm long, 7 mm wide, pale yellow-brown with a pale brown margin 0.4–0.5 mm wide, margin smooth and entire, surface smooth and glossy, coma about 2.5 cm long, pale tawny.

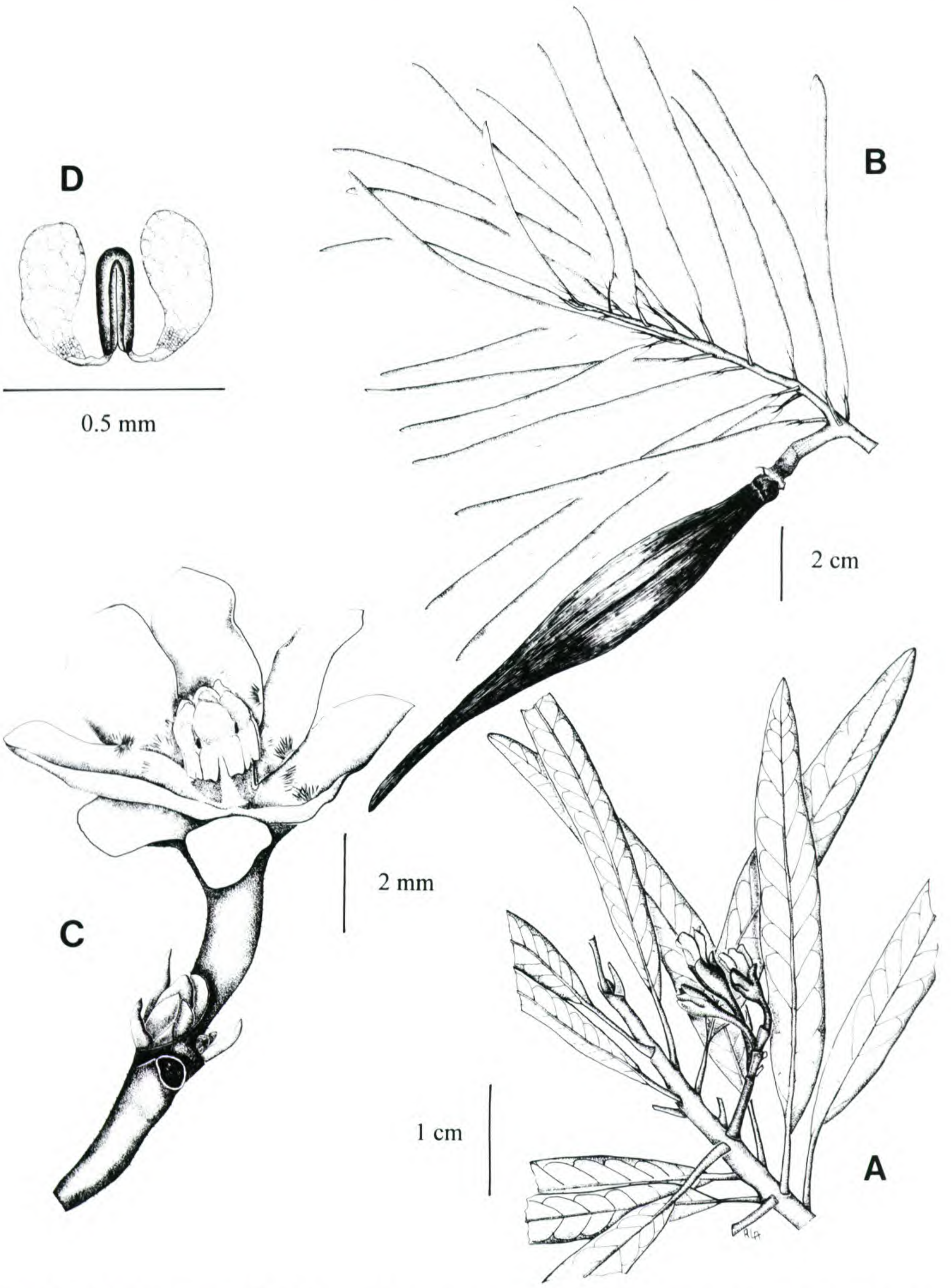

Figure 1. *Marsdenia carterae* W. D. Stevens & Juárez-Jaimes. —A. Flowering branch. —B. Fruiting branch. —C. Flower, corolla partially opened. —D. Pollinarium. Drawn from the type collection.

This species seems to be restricted to the eastern slopes of the Sierra de la Giganta, on dry cliffs and talus slopes, 75–1050 m in elevation. Sierra de la Giganta is an elongate range on the southeastern coast of Baja California. The few collections suggest that it flowers and fruits throughout the year.

Marsdenia is a genus of perhaps 200 species found throughout the tropics and subtropics. This is the first North and Central American species with verticillate leaves and only the second with a non-twining habit; the other non-twining Mexican species, *M. neriifolia* (Decaisne) Woodson, is an erect shrub. *Marsdenia carterae* is superficially similar in habit and leaf arrangement to *M. ericoides* Schlechter, an unrelated species from New Caledonia which may occupy similarly dry habitats. While the corona of *Marsdenia* is often reduced to a fleshy ridge on the back of each anther, this species seems to entirely lack the structure, a character state perhaps unique among species of *Marsdenia* without long, tubular corollas. *Marsdenia* is the only New World genus unambiguously placed within the tribe Marsdenieae, characterized by erect, uniformly fertile pollinia, and this species clearly falls within the genus, although probably in a rather isolated position. No clearly related species have been identified. There is no adequate infrageneric classification of the genus, and this species would not fit well into any of the inadequate ones.

Paratypes. MEXICO. **Baja California Sur:** nearly vertical N-facing slope near summit of Pilón de las Parras, W of Loreto, Sierra de la Giganta, 1050 m, 25°58′N, 111°30′W, 14 Mar. 1961, *A. Carter & H. Sharsmith 4220* (MO, UC); steep N-facing slope, Cañada de Tripuí SW of Puerto Escondido, Sierra de la Giganta, 400 m, 25°47.25′N, 111°21′W, 1 Dec. 1961, *A. Carter 4353* (MO, UC); at mouth of Cajón del Salto, Bahía [Puerto] Agua Verde, Sierra de la Giganta, 75 m, 25°30′N, 111°05′W, 25 Aug. 1971, *A. Carter 5605* (UC); lower cliffs, N base of Cerro Mechudo, Sierra de la Giganta, 700 m, 24°48′N, 110°43′W, 2 Nov. 1971, *R. Moran 18902* (UC).

This remarkable new species is dedicated to Annetta Mary Carter (1907–1991), who first discovered the species in 1961 and brought it to the senior author's attention many years ago. The illustration was prepared by Alba Arbelaez. Bruce Hansen and Mark Fishbein provided useful comments on an earlier version of the manuscript.

Dos Nuevas Especies de *Simira* (Rubiaceae) de Colombia

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RESUMEN. Se describen dos especies nuevas basadas en colecciones recientes de Colombia: *Simira cesariana* C. M. Taylor, del departamento de Cesar, y *S. hirsuta* C. M. Taylor, del Cañón del Río Claro en el departamento de Antioquia.

ABSTRACT. Two new species are described based on recent collections from Colombia: *Simira cesariana* C. M. Taylor, from Cesar Department, and *S. hirsuta* C. M. Taylor, from the Rio Claro Canyon in Antioquia Department.

Durante el estudio de colecciones recientes de Colombia, se descubrieron las dos especies nuevas tratadas aquí. El género *Simira* Aublet (antes tratado ampliamente bajo el sinónimo *Sickingia* Willdenow; Steyermark, 1972) se caracteriza en parte por los frutos, que son capsulares, leñosos, globosos, lisos y loculicidos con dos valvas hemisféricas, o éstas a veces tardiamente partiéndose otra vez en dos para un total de cuatro valvas. Tenemos hoy día un entendimiento limitado de este género, entonces es difícil decir con certitud las afinidades de estas especies nuevas. Sin embargo, estas dos especies nuevas se distinguen claramente de las otras especies de *Simira* ya conocidas por los caracteres mencionados debajo de cada descripción.

Simira cesariana C. M. Taylor, sp. nov. TIPO: Colombia. Cesar: ca. 5 km W of Manaure on road to La Paz, 10°22′N, 73°08′W, 540 m, 26 Apr. 1987, *A. Gentry & H. Cuadros 57130* (holótipo, MO-3585016). Figura 1A, B.

Haec species a congeneris pubescentia puberula breviter pilosa vel hirsutula, foliis tenuibus basi abrupte truncatis vel cordulatis, limbo calycino truncato vel late et non profunde lobulato 1.2–1.5 mm longo atque fructu diametro 3.5–4.0 cm distinguitur.

Arboles, floreciendo a 10 m de altura; tallos pubérulos o corto-pilósulos a glabrescentes. *Hojas* opuestas; *láminas* oblanceoladas, 8–15 cm de largo, 4–7 cm de ancho, con ápice agudo a ligeramente acuminado, con base angosta y luego abruptamente truncada a cortamente cordada, papiráceas, en la haz glabras excepto pubérulas en la costa y las venas secundarias, en el envés moderada a densamente hirsútulas; venas secundarias 13–17 pares, débilmente extendiéndose hasta las márgenes, a veces con domacios de tricomas en las axilas, en la haz la costa y las venas secundarias planas a ligeramente sulcadas y la venación menor reticulada y plana a promínula, en el envés la costa promínula a prominente, las venas secundarias y la venación menor promínulas; *pecíolos* 4–7 mm de largo, densamente pubérulos a pilósulos; *estípulas* interpeciolares, caducas, triangulares a lanceoladas, ligeramente resinosas, en la superficie externa densamente seríceas, en la superficie interna glabras, hasta 15 mm de largo, agudas a acuminadas. *Inflorescencias* terminales, subsésiles (o tripartidas), 4–5 cm de largo, con los ejes, brácteas y pedicelos densamente pubérulos a pilósulos, algunos ejes secundarios subtendidos por hojas reducidas (o brácteas foliáceas) de 1.5–3.5 cm de largo pero los ejes menores ebracteados o raramente con brácteas angostamente triangulares a angostamente elípticas, 1.5–2 mm de largo; pedicelos hasta 2 mm de largo; *flores* sésiles y pediceladas en címulas, con hipanto angostamente cilíndrico a angostamente turbinado, densamente pilósulo a pubérulo, 1.5–2 mm de largo; *limbo calicino* con exterior densa y completamente pilósulo a pubérulo o glabrescente cerca de la margen, el interior glabro, 1.2–1.5 mm de largo, truncado o amplia y brevemente lobulado; *corola*, estambres, estilo y estigma no observados. *Frutos* globosos a ligeramente oblados, leñosos, lisos, 3.5–4 cm de diámetro; semillas hemisféricas, 25–28 × 10–13 mm, con alas ca. ⅔ de este tamaño.

Distribución, hábitat y fenología. En bosque semihúmedo a 440–540 m en el noreste de Colombia. Colectada después de la antesis en abril, con frutos maduros en enero.

Esta especie se distingue por la pubescencia corta, hojas con la base abruptamente truncada a cortamente cordada, limbo calicino 1.2–1.5 mm de largo y truncado o amplia y brevemente lobulado y los frutos 3.5–4 cm de diámetro; se conoce sólo de la localidad típica. Desafortunadamente, las inflorescencias e infructescencias no se preservaron bien en las muestras estudiadas. El epiteto se refiere al departamento colombiano donde se ha encontrado esta especie. *Simira cordifolia* (Hooker f.) Steyermark es similar a esta especie nueva. *Simira*

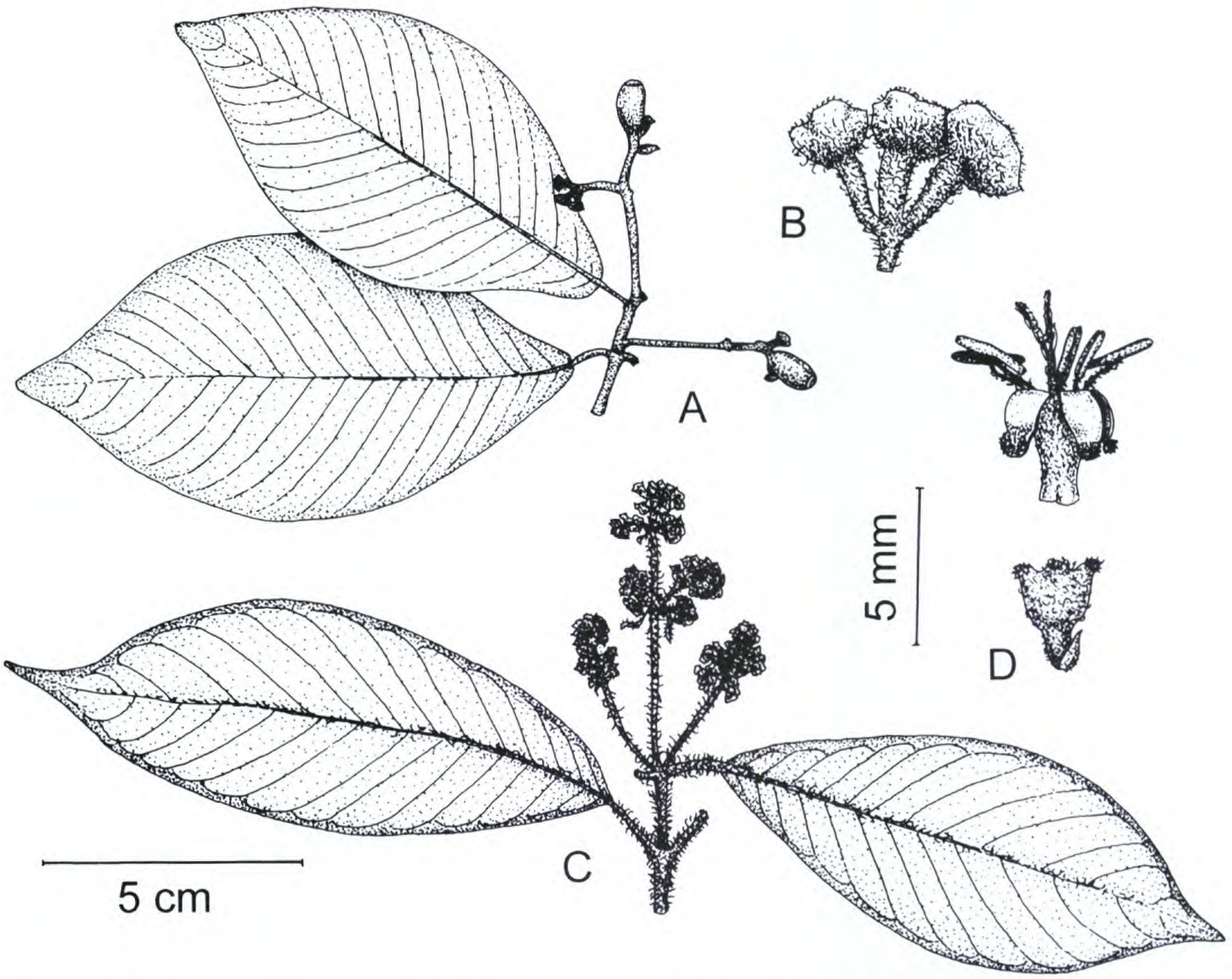

Figura 1. A, B. *Simira cesariana* C. M. Taylor, basada en *Gentry & Cuadros 57130*. —A. Rama con frutos inmaduros. —B. Címula de la inflorescencia con tres flores después de la antesis, con hipanto y limbo calicino. C, D. *Simira hirsuta* C. M. Taylor, basada en *Cogollo & Borja 1577*. —C. Rama con inflorescencia después de la antesis. —D. Flor en la antesis, parcialmente disectada. A, C escala de 5 cm; B, D escala de 5 mm.

cordifolia se distingue de *S. cesariana* por los órganos vegetativos glabros a pubérulos, en cada caso menos pubescente; las hojas usualmente mayores, 13–23 × 5–15 cm, y de forma diferente, usualmente más anchas en el medio o la mitad basal; las inflorescencias de forma diferente, pedunculadas y no o sólo ligeramente tripartidas; y el limbo calicino mas corto, hasta 1 mm de largo.

Parátipo. COLOMBIA. **Cesar:** 5 km W of Manaure, 10°22′N, 73°08′W, *Gentry et al. 60694* (MO).

Simira hirsuta C. M. Taylor, sp. nov. TIPO: Colombia. Antioquia: Municipio de San Luis, Cañón del Río Claro, sector sur-oriental, 05°53′N, 74°39′W, 350–450 m, 29 Apr. 1984, *A. Cogollo & R. Borja 1577* (holótipo, JAUM; isótipo, MO-5057408). Figura 1C, D.

Haec species a congeneris pubescentia hirsuta, foliis basi rotundatis truncatisve, limbo calycino 2.0–2.2 mm longo, corollae tubo ca. 4 mm longo ac lobulis ca. 3 mm longis, filamentis hirtellis, stylo trichomatibus adscendentibus sericeis induto atque fructu diametro ca. 3 cm distinguitur.

Arboles hasta 25 m de alto, floreciendo a 8 m de altura; tallos hirsutos a glabrescentes. *Hojas* opuestas; *láminas* elípticas a ligeramente oblanceoladas, 7–18 cm de largo, 2.5–6.5 cm de ancho, con ápice agudo a usualmente acuminado con acumen hasta 12 mm de largo, con base breve a ampliamente redondeada a truncada, papiráceas, en la haz glabras excepto hirsútulas en la costa y a veces también las venas secundarias, en el envés esparcidamente hirsutas en la lámina y moderada a densamente hirsutas en costa y venas secundarias; venas secundarias 12–13 pares, débil a claramente uniéndose en una vena submarginal, aparentemente sin domacios en las axilas, en la haz la venación toda plana o la costa y las venas secundarias a veces ligeramente sulcadas, en el envés la costa promínula a prominente, las venas secundarias promínulas y la venación menor reticulada y promínula; *pecíolos* 3–22 mm de largo, hirsutos; *estípulas*

interpeciolares, caducas, triangulares a lanceoladas, en la superficie externa hirsutas, en la superficie interna glabras, hasta 20 mm de largo, agudas a acuminadas. *Inflorescencias* terminales, subsésiles (o tripartidas), 4–5 cm de largo, piramidales a angostamente piramidales, 5–9 × 3–7 cm, con los ejes, brácteas y pedicelos hirsutos, con brácteas angostamente triangulares, 1.5–10 mm de largo; pedicelos hasta 2 mm de largo; *flores* aparentemente protandras, sésiles y pediceladas en címulas o fascículos de 5–15; hipanto angostamente turbinado, pubérulo a corto-pilósulo, 1.5–2 mm de largo; *limbo calicino* externamente hirsútulo, internamente glabro, cupuliforme o infundibuliforme, 2–2.2 mm de largo incluyendo los lóbulos 0.3–1 mm de largo, deltoides; *corola* infundibuliforme, amarilla pálida, exterior brevemente seríceo con tricomas ascendentes, interior glabro excepto por un anillo piloso un poco abajo del ápice del tubo, tubo ca. 4 mm de largo, ca. 1 mm de diámetro en la base y ca. 2.5 mm de diámetro en el ápice, lóbulos 5, angostamente triangulares, ca. 3 mm de largo, agudos; *anteras* ca. 2.5 mm de largo, exertas sobre filamentos ca. 2.5 mm de largo e hirtelos; *estigmas* ca. 1.5 mm de largo, exertos sobre un estilo ca. 4 mm de largo y seríceo con tricomas ascendentes. *Frutos* globosos, leñosos, lisos, ca. 3 cm de diámetro; semillas maduras no observadas.

Distribución, hábitat y fenología. En bosque húmedo con substrato de cálice en el noroeste de Colombia, a 325–520 m. Colectada con flores de marzo a mayo y en diciembre, con frutos en marzo, abril y julio a octubre.

Esta especie se distingue de otras especies de *Simira* por su pubescencia hirsuta, las hojas redondeadas a truncadas en la base, el limbo calicino 2–2.2 mm de largo, la corola con el tubo ca. 4 mm de largo y los 5 lóbulos ca. 3 mm de largo, los filamentos hirtelos, el estilo seríceo y los frutos ca. 3 cm de diámetro; se conoce sólo de la región típica. El epiteto se refiere a su pubescencia distintiva. Otras especies similares son *Simira cordifolia* (Hooker f.) Steyermark, *S. klugei* (Standley) Steyermark y *S. mollis* (Standley) Steyermark. *Simira cordifolia* se distingue de *S. hirsuta* por los órganos vegetativos y ejes de la inflorescencia glabros a pubérulos, en cada caso menos pubescentes; el limbo calicino mas corto, hasta 1 mm de largo; los filamentos pubérulos, i.e., menos pubescentes; y el estilo glabro, i.e., menos pubescente. *Simira klugei* se distingue de *S. hirsuta* por la pubescencia diferente, hirtela y más corta; las hojas menores, 3–8 × 2–6 cm, y menos pubescentes, glabras en el envés; el limbo calicino mas corto, hasta 1 mm de largo; los filamentos pubérulos, i.e., menos pubescentes; y el estilo glabro, i.e., menos pubescente. *Simira mollis* se distingue de *S. hirsuta* por las flores sésiles en lugar de pediceladas; el limbo calicino mas largo, 6–8 mm de largo, y de forma diferente, profundamente lobulado; y la corola de pubescencia diferente, densamente tomentulosa externamente.

Parátipos. COLOMBIA. **Antioquia:** Municipio de San Luis, Parque Ecológico Cañón del Río Claro, 05°53′N, 74°39′W, sector occidental, margen izquierda, subida a la Dolina, *Cogollo & Borja 463* (JAUM, MO), sector sur-oriental, margen derecha, *Cogollo 659* (JAUM, MO), sector central, margen izquierda, *Cogollo & Borja 736* (JAUM, MO), sector occidental, margen izquierda, *Cogollo 1013* (JAUM, MO), sector sur-oriental, margen izquierda, *Cogollo 1466* (JAUM, MO), sector sur-occidental, *Cogollo & Borja 1616* (JAUM, MO), *Cogollo 1702* (JAUM, MO), sector nor-occidental, margen izquierda, *Cogollo 1906* (JAUM, MO), *Cogollo & Borja 2026* (JAUM, MO); municipio de Puerto Triunfo, alrededores de la Gruta "El Cóndor," 5°56′N, 74°50′W, *Cogollo et al. 4276* (JAUM, MO).

Agradecimientos. Agradezco al personal y los institutos de los herbarios HUA, JAUM y TULV el acceso a las colecciones, hospedaje y facilitar viajar en Colombia; a R. E. Gereau (MO) la preparación de la diagnosis en latín; a A. Arbelaez (MO) la revisión del español; y en particular a los colegas W. Devia (TULV) y A. Cogollo (JAUM) la colaboración generosa que me han ofrecido durante mis estudios.

Literatura Citada

Steyermark, J. A. 1972. *Simira*. *In*: B. M. Maguire & Collaborators, Flora of the Guayana Highlands. Mem. New York Bot. Gard. 23: 299–309.

New Taxa and Combinations in the *Ocotea helicterifolia* (Lauraceae) Species Group

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ABSTRACT. In the course of preparing a treatment of the *Ocotea helicterifolia* group for *Flora Mesoamericana*, the existing treatment was found to be outdated. A review of the group is here presented and includes the description of the following new species: *O. congregata* van der Werff, *O. corrugata* van der Werff, *O. gordonii* van der Werff, and *O. patula* van der Werff, as well as the following new combinations: *O. betazensis* (Mez) van der Werff, *O. bourgeauviana* (Mez) van der Werff, *O. purpurea* (Mez) van der Werff, and *O. tonii* (Lundell) van der Werff. A key to the species of the group is presented, new synonymy is given, and the specimens studied are listed.

Among the species of *Ocotea* in Central America is a group characterized by the presence of an erect indument on the leaves (especially on the lower surface) that is discernible to the touch, with densely to moderately pubescent twigs, tepals that are partially papillose (sometimes only along the margin or near the tip), glabrous or somewhat papillose anthers with the four cells arranged in two superposed pairs and, at least in some species, relatively well-developed staminodia. The term papillose is used here for a dense cover of very short, curly hairs. In a few species the anthers each have a small, sterile tip and the anther cells do not fill the anther completely, as is the case in most species of *Ocotea*. Although this group is easy to recognize, its taxonomy is confused. The presence of well-developed staminodia has resulted in the inclusion of several species in *Phoebe*, and later those were transferred to *Cinnamomum*. Other species have been placed in *Nectandra*, sharing a common papillosity of the tepals and anthers. *Nectandra belizensis* (Lundell) Allen resembles in vegetative characters the *O. helicterifolia* group, but has typical *Nectandra* stamens (short, broad, with the anther cells arranged in a shallow arc, not in two superposed pairs as in *Ocotea*). *Nectandra belizensis* is known from Belize, Costa Rica, and Panama. Rohwer (1991) gave a brief discussion of the group and provided a list of taxa included in it. He also revised the species with the general flower structure of *O. helicterifolia*, but which did not have the pubescent leaves and twigs. He noted that the *O. helicterifolia* group is related to the *Ocotea sinuata* group, which differs in having tongue-shaped anthers each with a conspicuous sterile tip.

In the course of writing a treatment of *Ocotea* for *Flora Mesoamericana*, I found several undescribed species in the *O. helicterifolia* group and several other species that needed to be transferred to *Ocotea*. A few species of this group occurred outside the area covered by *Flora Mesoamericana*. In addition to the novelties, I decided it might be useful to publish a key to all species I recognize as belonging to the *O. helicterifolia* group, as well as new synonyms. In the most recent treatment of Central American Lauraceae (Allen, 1945), most species of the *O. helicterifolia* group were included in *Phoebe*, and these species were mostly separated based on leaf size and leaf shape. I found these characters less important than Allen did, and rely more on such characters as inflorescence type (racemose or paniculate-cymose), flower characters (flowers glabrous or pubescent; inner surface of tepals glabrous or pubescent; receptacles glabrous or pubescent inside), and leaf position (alternate or clustered). Use of these characters leads to better-defined species, although some of the species appear quite variable and may be further divided at some later point. Specifically, the Costa Rican specimens of *O. helicterifolia* seem slightly different and occur at lower altitudes than specimens collected north of Costa Rica. Likewise, specimens of *O. purpurea* from Panama seem different (fewer lateral veins, for example) than those from Honduras northward. However, splitting these species can only be done using vegetative characters (leaf shape and size), and because I regard these characters as weak and not reliable, I am reluctant to further divide these rather variable species.

In several species the upper rim of the receptacle carries a ring of hairs. These hairs are easily visible and may suggest the receptacle itself is pubescent or the tepals are pubescent on the inner surface. It is necessary to split a receptacle open in order to ascertain whether the receptacle is pu-

bescent inside: a view from above is not sufficient. I only describe tepals as pubescent on the inner surface if the hairs extend at least halfway the length of the tepals; a tuft of hairs visible at or near the base of the tepals is not enough to score the inner surface of the tepals as pubescent.

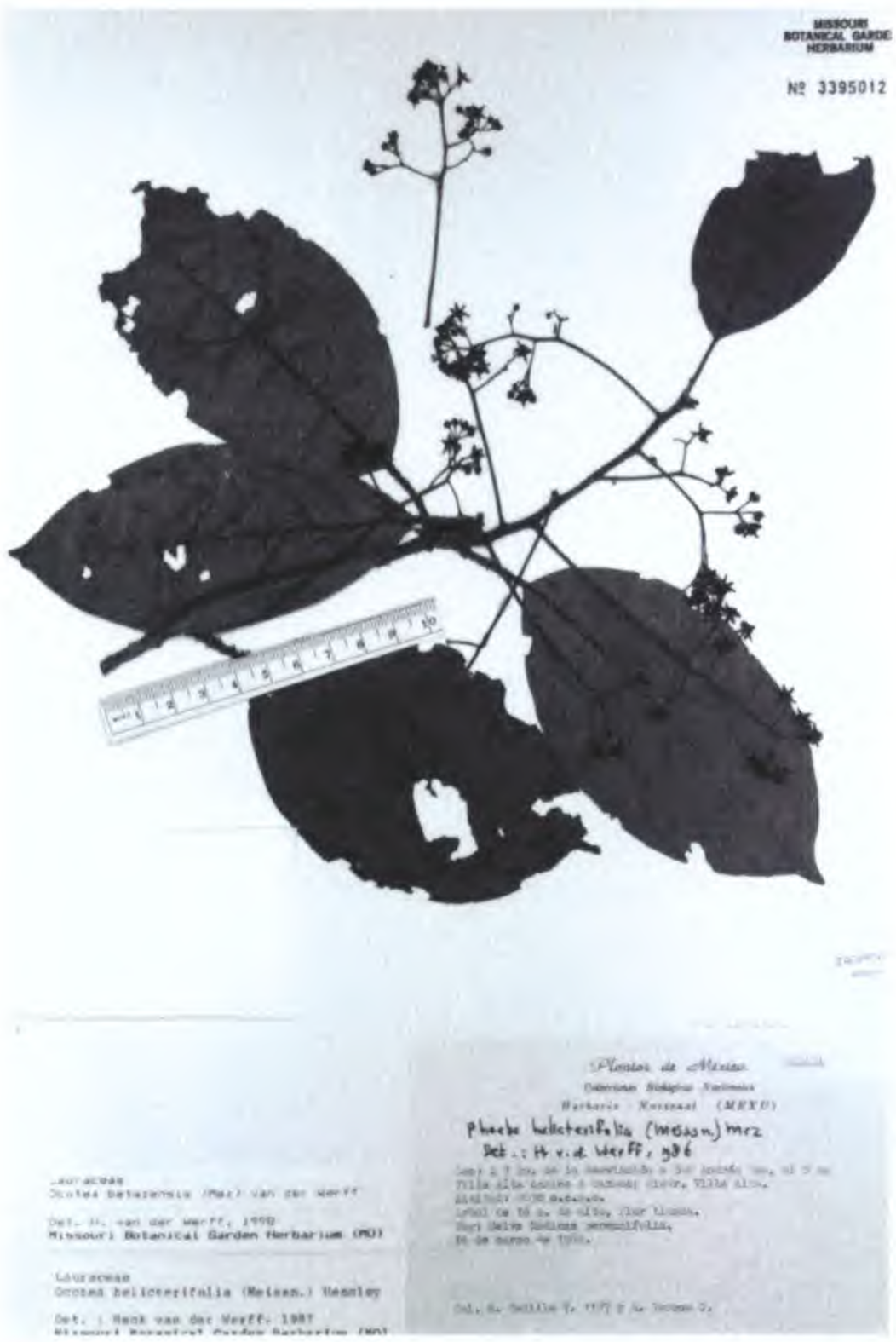
KEY TO SPECIES OF THE *OCOTEA HELICTERIFOLIA* GROUP IN CENTRAL AMERICA

1a. Inflorescences racemose or rarely with one or two lateral cymes.
  2a. Leaves obovate; tufts or lines of white hairs common along major veins on lower leaf surface . . . . . 15. *O.* sp. nov.
  2b. Leaves elliptic; axillary tufts of hairs lacking or only a few on each leaf.
    3a. Leaves bullate-rugose, the major veins strongly impressed on the upper leaf surface . . . . . 4. *O. corrugata*
    3b. Upper leaf surface smooth or nearly so, the major veins immersed, not strongly impressed.
      4a. Outer surface of tepals glabrous; anthers sessile . . . . . 5. *O. gordonii*
      4b. Outer surface of tepals at least sparsely pubescent; stamens with filaments 1/3 or more of the length of the anthers.
        5a. Hairs on lower leaf surface ascending, covering most of the lamina; indument gray . . . . . 8. *O. mollicella*
        5b. Hairs on lower leaf surface erect, most of the lamina visible; indument brown or ferruginous . . . . . 11. *O. purpurea*
1b. Inflorescences paniculate.
  6a. Leaves clustered.
    7a. Outer surface of tepals glabrous . . . . . 2. *O. bourgeauviana*
    7b. Outer surface of the tepals pubescent.
      8a. Petioles to 6 mm long; leaves 15–25 × 5–6 cm; twigs with yellowish brown indument . . . . . 12. *O. tonii*
      8b. Petioles at least 10 mm long; leaves 9–17 × 4–7 cm; twigs with brown indument . . . . . 3. *O. congregata*
  6b. Leaves alternate, evenly distributed along the twigs.
    9a. Receptacle pubescent inside.
      10a. Leaves elliptic, to 15 cm long . . . . . 1. *O. betazensis*
      10b. Leaves obovate, 18–40 cm long.
        11a. Indument completely covering young twigs and inflorescences . . . . . 14. *O. valerioides*
        11b. Surface of twigs and inflorescences visible between the indument . . . . . 7. *O. lentii*
    9b. Receptacle glabrous inside.
      12a. Outer surface of tepals pubescent.
        13a. Leaves broadly elliptic; tufts of white hairs lacking in axils of lateral veins or along the major veins . . . . . 9. *O. patula*
        13b. Leaves obovate; tufts of white hairs present in axils of lateral veins and along the major veins . . . . . 15. *O.* sp. nov.
      12b. Outer surface of tepals glabrous.
        14a. Inner surface of tepals pubescent; filaments evident, ca. 1/3 the length of the anthers.
          15a. Leaves to 10 cm long, the tips obtuse, acute or shortly acuminate . . . . . 10. *O. praetermissa*
          15b. Leaves 13–20 cm long, acuminate or gradually narrowed into a slender tip . . . . . 2. *O. bourgeauviana*
        14b. Inner surface of tepals glabrous; anthers sessile.
          16a. Surface of young twigs completely covered by the indument; cupule cup-shaped . . . . . 13. *O. valeriana*
          16b. Surface of young twigs partially visible between the indument; cupule only shallowly bowl-shaped or platelike . . . . . 6. *O. helicterifolia*

1. Ocotea betazensis (Mez) van der Werff, comb. nov. Basionym: *Phoebe betazensis* Mez, Jahrb. Koenigl. Bot. Gart. Berlin 5: 192. 1889. SYNTYPES: Mexico. Oaxaca: *Liebmann 2(C), 3(C), 22(C), 23(C), Galeotti 2885* not seen, *Juergensen 575* not seen. Figure 1.

Oreodaphne mexicana Meisner var. *diminuta* Meisner, Prodr. 15(1): 118. 1864. *Ocotea mexicana* (Meisner) Hemsley var. *diminuta* (Meisner) Hemsley, Biol. Centr. Amer., Bot. 3: 73. 1882. TYPE: *Juergensen 575* not seen.

Ocotea betazensis (as *Phoebe betazensis*) has long been included in *Ocotea helicterifolia*, from which it differs in the elliptic to broadly elliptic (not obovate) leaves, the stamens with well-developed filaments, the dense tomentellous-tomentose indument on the young twigs that completely covers the surface (not hirsute with the surface partially visible), and the generally longer petioles than seen in *O. helicterifolia*. *Ocotea betazensis* is currently only known from cloud forests between 1900 and 2600 m altitude in Oaxaca, but can be expected in neighboring Chiapas.



Figures 1–4 (clockwise from top left). —1. *Ocotea betazensis*: *Cedillo 1197*. —2. *Ocotea bourgeauviana*: *Breedlove 50583*. —3. *Ocotea congregata*: *Mendez Ton 9594*. —4. *Ocotea corrugata*: *Wendt et al. 6765* (isotype).

2. Ocotea bourgeauviana (Mez) van der Werff, comb. nov. Basionym: *Phoebe bourgeauviana* Mez, Jahrb. Koenigl. Bot. Gart. Berlin 5: 194. 1889. *Cinnamomum bourgeauvianum* (Mez) Kostermans, Reinwardtia 6: 20. 1961. TYPE: Mexico. Veracruz: *Bourgeau 2234* (isosyntype, MO). Figure 2.

Nectandra longicuspis Lundell, Wrightia 5: 34. 1974. Syn. nov. TYPE: Guatemala. Izabal, *Contreras 11186* (isotype, MO).

Phoebe chinantecorum R. E. Schultes, Bot. Mus. Leafl. 9: 170. 1941. Syn. nov. *Cinnamomum chinantecorum* (R. E. Schultes) Kostermans, Reinwardtia 6: 20. 1961. TYPE: Mexico. Oaxaca: *Schultes & Reko 827* (holotype, GH).

Ocotea bourgeauviana can be recognized by the combination of paniculate-cymose inflorescences, glabrous flowers, pubescent inner surface of the tepals, and the mostly clustered leaves. The indument on the twigs is hirsute, with the surface of the twigs partially visible between the indument. Leaf size ranges from 13 to 20 cm long. It is known from Mexico (Veracruz, Chiapas), Guatemala, and Honduras at altitudes ranging from 100 to 1200 m, but is infrequently collected. Provisionally placed here are some collections from Veracruz (Mexico) with a glabrous inner surface of the tepals and slightly smaller flowers (4–5 mm diam. vs. 5–6 mm in *O. bourgeauviana*). Because these specimens differ in only one solid character (the glabrous inner surface of the tepals) from *O. bourgeauviana*, I am reluctant to recognize them as a distinct species and list them in the specimens studied as *O.* aff. *bourgeauviana.*

3. Ocotea congregata van der Werff, sp. nov. TYPE: Mexico. Chiapas: Mpio. Oxchuc, Cascada de Coralito, *Shilom Ton 8930* (holotype, MO). Figure 3.

Ocoteae tonii similis, sed foliis brevioribus, latioribus, petiolis plus quam 10 mm longis, indumento castaneo differt.

Small to medium-sized trees, to 15 m tall. Twigs terete, solid, densely brown-tomentose or tomentellous, the hairs erect and twisted, covering the surface of the young twigs completely, terminal buds densely brown-tomentose. Leaves 9–17 × 4–7 cm, elliptic to broadly elliptic, firmly chartaceous, clustered, the base rounded or obtuse, rarely acute, the apex obtuse to acute, midrib and lateral veins impressed, tertiary venation weakly impressed on the upper surface, midrib and major veins prominently raised, smaller veins raised on the lower surface; upper surface moderately pubescent when young, the hairs erect, soon becoming glabrous, the pubescence denser and persisting along the major veins, lower surface moderately densely pubescent, the hairs erect and discernible to the touch, the surface readily visible between the hairs, the indument denser and tomentose along the midrib and lateral veins; domatia lacking; petioles 10–25 mm, round, with a similar indument as the twigs. Inflorescences 5–12 cm, paniculate-cymose, the flowers in compact clusters, densely hirsute-tomentose, mostly in the axils of bracts, infrequently in the axils of leaves. Flowers 7–9 mm diam., white, perfect, the receptacle densely pubescent outside; pedicels ca. 3 mm long. Tepals 3 mm long, elliptic, the outside moderately to sparsely pubescent, the inside pubescent near the base, otherwise glabrous, spreading at anthesis, outer 6 stamens 1.6 mm, sessile or nearly so, with a few hairs near the base, otherwise glabrous, the cells arranged in 2 pairs, introrse, at the tip with a narrow, sterile border, inner 3 stamens 1.7 mm, the filament 0.5 mm, with a few hairs, the cells in 2 pairs, extrorse-lateral, glands present at the base of the filaments, staminodia 3, minute, stipitiform, hidden between the hairs on the top of the receptacle; pistil 1.5 mm, glabrous, the style 0.4 mm, receptacle cup-shaped, appressed pubescent or glabrous inside. Fruit ellipsoid, 2 × 1.3 cm, the cupule deeply cup-shaped when young, bowl-shaped at maturity, 1 cm diam., with a single margin, the tepals deciduous. Flowers March, April, November; fruits August, October.

Ocotea congregata is named after the erect stamens grouped in a rather tight cluster. The new taxon is currently only known from the Mexican state of Chiapas and occurs between 800 and 1370 m altitude. It can be recognized by the slightly bullate, loosely clustered leaves, the pubescent flowers arranged in paniculate-cymose inflorescences, the brown to dark brown indument on the twigs, and the rather long (10 mm or more) petioles. Its closest relative is *Ocotea tonii*, which differs in its narrower, longer leaves, shorter petioles (to 6 mm long), and the yellowish brown indument on the young twigs.

Paratypes. MEXICO. **Chiapas:** Mpio. Ocosingo, *Breedlove 15672* (CAS), *33017* (CAS, MO), *52589* (CAS, MO), *Martinez S. 17084* (MO), *Quintanilla 49* (MO); Mpio. San Cristobal de las Casas, *Mendez Ton 9594* (CAS, MO); Mpio. Oxchuc, *Shilom Ton 8503* (MO).

4. Ocotea corrugata van der Werff, sp. nov. TYPE: Mexico. Oaxaca: Mpio. Sta. Maria Chimalapa, Sierra de Tres Picos, alt. 1150–1250 m, *T. Wendt, Hernandez G., Tenorio, Torres, Salazar, Soto & Rocha 6765* (holotype, MEXU; isotype, MO). Figure 4.

Ad gregem *Ocoteae helicterifoliae* pertinens, sed foliis corrugatis diversa est.

Small tree, to 4 m. Twigs terete, densely brown-tomentellous, the surface of the young twigs not visible, solid; terminal buds densely tomentellous. Leaves 7–14 × 2.5–7 cm, elliptic or broadly elliptic, firmly chartaceous, alternate, the base variable, from acute or obtuse to rounded, the apex acute or obtuse, the upper surface sparsely pubescent with erect or ascending hairs when young, soon becoming glabrous, the lower surface sparsely pubescent, the hairs erect and discernible to the touch, the indument denser and tomentellous along the major veins, midrib, lateral veins, and tertiary venation impressed on the upper surface, strongly raised on the lower surface, the leaves bullate to rugose, lateral veins 5 to 7, domatia absent, petioles 7–15 mm, flat above, with a similar indument as the twigs. Inflorescences 3–5 cm, racemose, less than 10-flowered, densely hirsute, the flowers grouped near the tip of the inflorescence. Flowers 7–8 mm diam., cream-colored, perfect, receptacle densely pubescent on the outside; pedicels 2–3 mm long. Tepals 3 mm long, elliptic, on both surfaces pubescent near the base, otherwise glabrous, spreading at anthesis; outer 6 stamens 1.5 mm, the filaments ca. 0.4 mm, with some hairs near the base, otherwise glabrous, the cells introrse, arranged in 2 pairs, a sterile tip lacking, inner 3 stamens 1.5 mm long, the filament 0.4 mm long, with 2 glands near the base, the cells in 2 rows, the upper row lateral, the lower one lateral extrorse, staminodia 3, clavate, with a few hairs, difficult to see among the hairs on the rim of the receptacle, pistil glabrous, ca. 1 mm long, the style very short, receptacle cup-shaped, appressed pubescent inside. Fruit and cupule unknown. Flowers April.

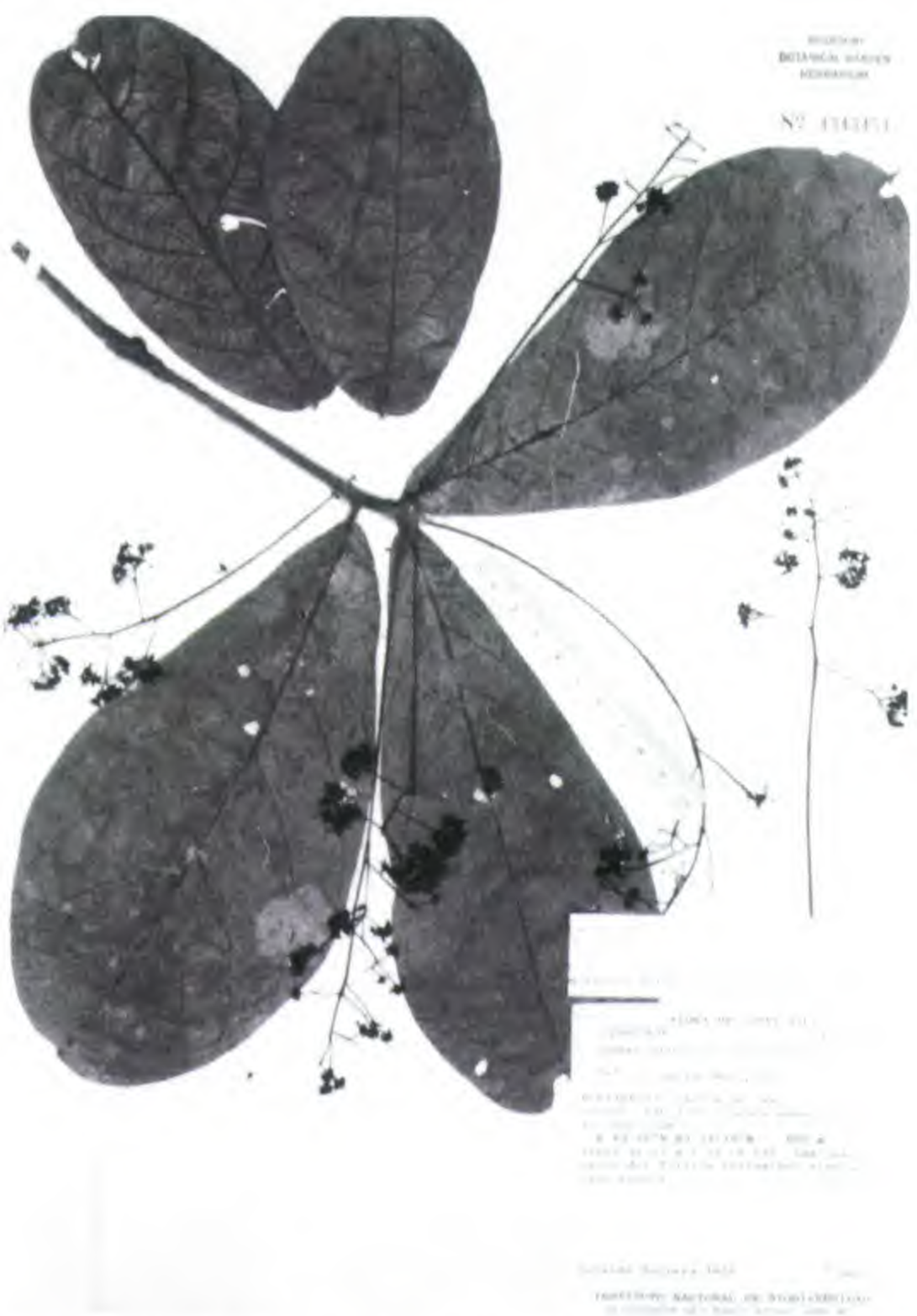
Although *Ocotea corrugata* is only known from the type collection, it is here described largely because of its very distinct, bullate to rugose leaves; additional characters are the racemose inflorescences and the pubescent inside of the receptacle. It belongs to the *Ocotea helicterifolia* group, where it does not seem to have a close relative. Racemose inflorescences are uncommon in this complex, but I do not think that *O. corrugata* is closely related to the other species with racemose inflorescences such as *O. purpurea* and *O. gordonii*. These species differ greatly from each other in other characters, and racemose inflorescences have probably arisen several times in this complex by reduction of the more common paniculate-cymose inflorescence. This species was described as abundant at the type locality. However, the remoteness of this locality made it difficult to bring back more material.

5. Ocotea gordonii van der Werff, sp. nov. TYPE: Panama. Chiriquí: vicinity of Fortuna Dam, *G. McPherson 10421* (holotype, MO). Figure 5.

Inter speciebus *Ocoteae helicterifoliae* gregis inflorescentia racemosa, receptaculo intus pubescente et pedicellis longis recedit.

Small trees, to 10 m tall. Twigs terete, solid, densely tomentose, the surface not or scarcely visible between the hairs; terminal buds densely tomentose. Leaves 12–22 × 5–8 cm, narrowly to broadly elliptic, chartaceous, alternate and evenly distributed along the twigs, the margin flat or sometimes folded downward, the base acute or obtuse to almost rounded, the tip acuminate with an acumen to 2 cm long or acute, the upper surface with some erect, curled hairs when young, but this indument rapidly wearing off, the hairs denser and becoming tomentose along the major veins, the lower surface copiously pubescent, the hairs erect and soft to the touch, denser and tomentose along the midrib and lateral veins, midrib and lateral veins somewhat impressed, tertiary venation slightly raised on the upper surface, midrib, lateral veins, and tertiary venation raised or prominently raised on the lower surface; lateral veins 6 to 8; domatia absent; petioles 8–14 mm, flattened on the upper side, with a similar indument as the twigs. Inflorescences 8–16 cm, racemose, moderately densely to sparsely pubescent, the hairs erect or spreading, to 0.6 mm long; in axils of bracts or, less frequently, of normal leaves. Flowers 8–10 mm diam., white, glabrous, fragrant, perfect, pedicels ca. 1 cm long. Tepals 6, 4–4.5 mm long, elliptic, spreading at anthesis, the outer 3 with a basal triangular papillose patch, otherwise glabrous, the inner 3 uniformly papillose on the inner surface; stamens 9, 4-celled, the outer 6 weakly papillose, the cells arranged in 2 rows, opening introrse-lateral, the anthers sessile or nearly so, sterile tip short, 0.2–0.3 mm, inner 3 stamens 1.5 mm long, the anther sessile, the cells arranged in 2 rows, laterally extrorse, the anthers weakly papillose and with a few hairs near the base, glands present at the base of the inner 3 stamens, staminodia not seen, receptacle cup-shaped, pubescent inside. Fruits and cupules not known. Flowers February–April.

Ocotea gordonii is part of the *Ocotea helicterifolia* complex because of the papillose inner surface of the tepals, the relatively large flowers, the long spreading indument of stems and leaves, and the spreading tepals. Within this group it stands



Figures 5–8 (clockwise from top left). —5. *Ocotea gordonii*: *McPherson 10421* (holotype). —6. *Ocotea helicterifolia*: *Linden 1641* (syntype). —7. *Ocotea helicterifolia*: *Mendez Ton 5902*. —8. *Ocotea helicterifolia* (Costa Rica): *Herrera 4866*.

apart due to its racemose inflorescences, the long pedicels, and pubescent receptacle. Only one other species in this group with racemose inflorescences is known from Panama, and this species, *O. purpurea*, has pubescent flowers ca. 5 mm in diameter and leaves less than 11 cm long. Vegetatively, there is a stronger resemblance between the new species and *O. valeriana* and *O. helicterifolia*, both of which occur in Costa Rica. These two species have paniculate-cymose inflorescences and glabrous receptacles. Two other species from Costa Rica and Panama, *O. lentii* and *O. valerioides*, have pubescent receptacles like *O. gordonii*, but differ in their paniculate-cymose inflorescences and obovate leaves.

This species is dedicated to Gordon McPherson, whose excellent collections have contributed much to our knowledge of the Panamanian flora.

Paratypes. PANAMA. **Veraguas:** mountains above Sta. Fe, *Hammel & Kress 8534* (MO). **Chiriquí:** vicinity of Fortuna Dam, *McPherson 10573* (MO).

6. Ocotea helicterifolia (Meisner) Hemsley, Biol. Centr. Amer., Bot. 3: 73. 1882. *Oreodaphne helicterifolia* Meisner, Prodr. 15(1): 123. 1864. *Phoebe helicterifolia* (Meisner) Mez, Jahrb. Koenigl. Bot. Gart. Berlin 5: 193. 1889. *Cinnamomum helicterifolium* (Meisner) Kostermans, Reinwardtia 6: 21. 1961. TYPE: Mexico. Chiapas: *Linden 1641* (syntype, K). Figures 6, 7, 8.

Nectandra corzoana Lundell, Wrightia 4: 102. 1969. Syn. nov. *Phoebe corzoana* (Lundell) Lundell, Wrightia 5: 342. 1977. *Cinnamomum corzoanum* (Lundell) Kostermans, Reinwardtia 10: 422. 1988. TYPE: Mexico. Chiapas: *Shilom Ton 3560* (holotype, LL).

Ocotea tenejapensis Lundell, Wrightia 4: 108. 1969. Syn. nov. TYPE: *Shilom Ton 779* (holotype, LL).

Phoebe nectandroides Mez, Jahrb. Koenigl. Bot. Gart. Berlin 5: 194. 1889. SYNTYPES: *Botteri 1018* not seen, *Galeotti 7004* (BR), *Juergensen 937* not seen, *Liebmann 4* not seen, *Oersted 21* not seen.

Phoebe obtusata Lundell, Contr. Univ. Mich. Herb. 6: 21. 1941. Syn. nov. *Cinnamomum obtusatum* (Lundell) Kostermans, Reinwardtia 6: 22. 1961. TYPE: Mexico. Chiapas: *Matuda 1887* (isotype, CAS).

Ocotea helicterifolia is characterized by its alternate leaves, glabrous flowers and inside of the receptacle, as well as the hirsute indument of the twigs, with at least a small part of the surface visible between the hairs. In Costa Rica it can be confused with *O. valeriana*, which has a denser indument on twigs and inflorescences. *Ocotea helicterifolia* occurs from southern Mexico to Panama at altitudes of 1000–1900 m; in Costa Rica it occurs at lower elevations (50–600 m) and has more obovate leaves. These collections from Costa Rica possibly represent an undescribed taxon. Provisionally included in *O. helicterifolia* is *Ocotea tenejapensis*, known only from the type collection. This collection differs from typical *O. helicterifolia* in that the outer 6 stamens have filaments about 1/3 the length of the anthers, the lower leaf surface is very sparsely pubescent, and small axillary tufts of hairs are often present on the lower leaf surface. I have not found other collections with these characters, and therefore include *O. tenejapensis* as a somewhat aberrant form in *O. helicterifolia*.

Because *O. helicterifolia* has a wide range of distribution and shows some variation in vegetative characters, I include three figures, including one of the type, of this species.

7. Ocotea lentii W. C. Burger, Fieldiana Bot., n.s. 23: 86. 1990. TYPE: Costa Rica. Cartago: *Lent 794* (isotype, MO). Figure 9.

Ocotea lentii is best recognized by its large (18–40 cm long), obovate, alternate leaves and the hirsute indument on twigs and inflorescences. Part of the surface remains visible between the hairs. *Ocotea lentii* is an infrequently collected species known only from the provinces Cartago and Guanacaste in Costa Rica. Most collections have been made between 700 and 1400 m altitude.

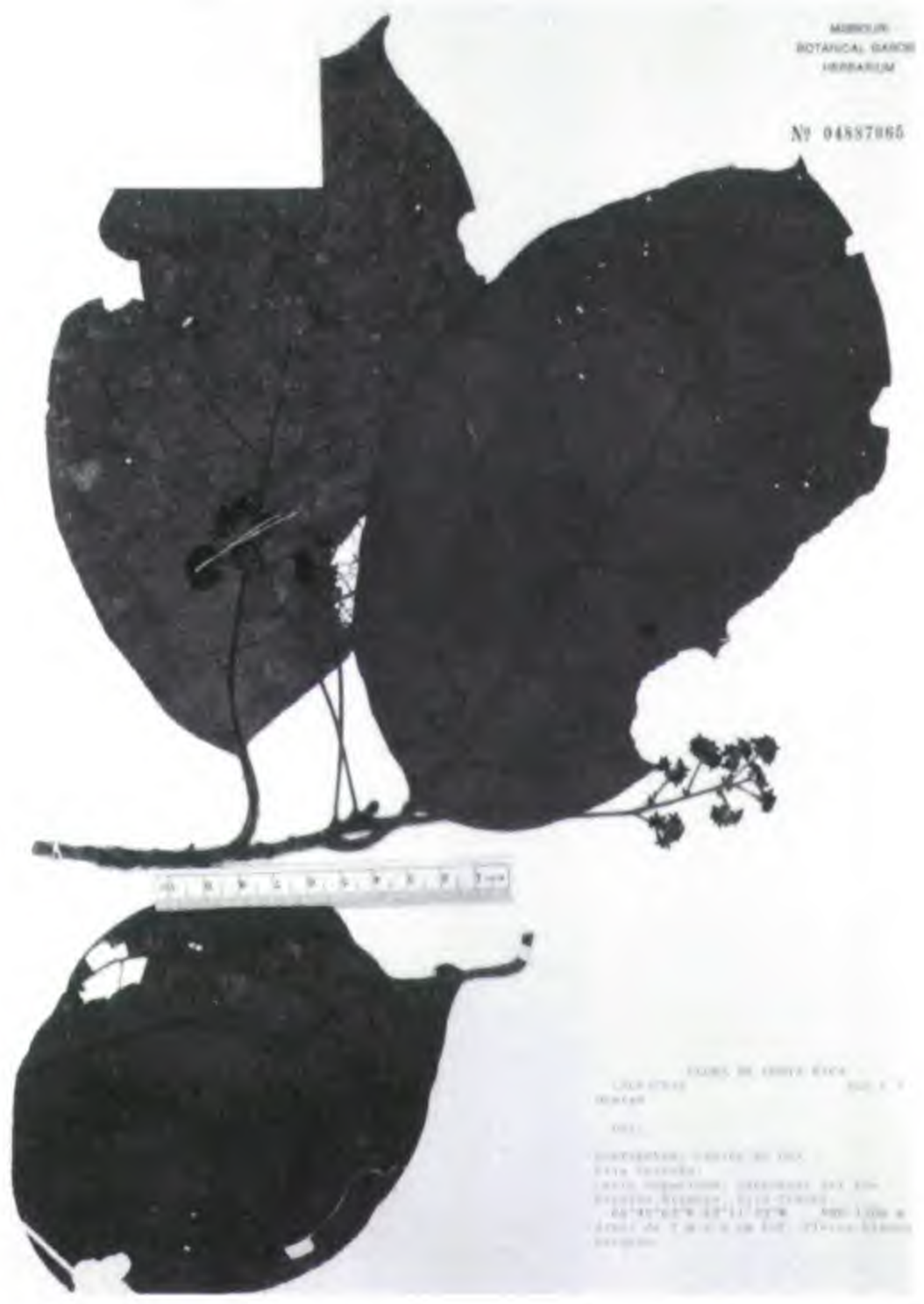
8. Ocotea mollicella (Blake) van der Werff, Fieldiana Bot., n.s. 23: 88. 1990. *Phoebe mollicella* Blake, Contr. Gray Herb. 52: 64. 1917. *Cinnamomum mollicellum* (Blake) Kostermans, Reinwardtia 6: 22. 1961. TYPE: Costa Rica. *Tonduz 11676* (isotype, G). Figure 10.

Ocotea mollicella is characterized by its racemose inflorescences, ascending (not erect) hairs on the lower leaf surface, and the gray color of the indument. Its leaves are narrowly elliptic to elliptic-lanceolate and generally less than 8 cm long. *Ocotea mollicella* is a rarely collected species only known from cloud forests in Costa Rica and occurring between 1400 and 2300 m altitude.

9. Ocotea patula van der Werff, sp. nov. TYPE: Costa Rica. Puntarenas: Canton de Osa, Fila Costena, *Aguilar et al. 2715* (holotype, MO). Figure 11.

Ocoteae valerianae similis, sed floribus pubescentibus pedicellis tomentellis brevioribusque recedit.

Small trees, to 8 m. Twigs terete or slightly ridged, solid, densely yellowish brown tomentose



Figures 9–12 (clockwise from top left). —9. *Ocotea lentii*: *Herrera 8938*. —10. *Ocotea mollicella*: *Tonduz 11676* (isotype). —11. *Ocotea patula*: *Aguilar 2715* (holotype). —12. *Ocotea praetermissa*: *Burger et al. 12065* (holotype).

when young, the surface completely covered by the indument, the indument becoming whitish with age, terminal buds densely yellowish brown tomentose. Leaves 12–24 × 9–14 cm, broadly elliptic, chartaceous, alternate, the base obtuse to rounded, the apex obtuse or shortly acuminate, the upper surface with some erect hairs when young, soon glabrescent, the midrib and lateral veins tomentellous, the lower surface sparsely to moderately pubescent, the hairs erect, the indument denser and tomentellous along the midrib and lateral veins, midrib, lateral veins, and tertiary venation immersed on the upper surface, raised to prominently raised on the lower surface, domatia lacking, lateral veins 7–8; petioles 17–26 mm long, with a similar indument as the twigs, shallowly canaliculate on the upper surface. Inflorescences 10–16 cm long, paniculate-cymose, densely yellowish brown tomentellous, in the axils of cataphylls, rarely in the axils of leaves. Flowers ca. 7 mm diam., white, perfect, sparsely to moderately pubescent; receptacle densely pubescent outside; pedicels ca. 2 mm long, tomentellous. Tepals ca. 2.5 mm long, elliptic, spreading or somewhat reflexed at anthesis, the inner surface moderately to sparsely papillose; stamens 9, 4-celled, the outer 6 ca. 1.2 mm long, weakly papillose, the cells arranged in 2 pairs, introrse, a short (0.2 mm) sterile tip present, the anthers sessile or nearly so, inner 3 stamens as long as the outer 6, also weakly papillose, sessile or nearly so, the cells in 2 pairs, extrorse, glands present at the base, staminodia not seen. Pistil ca. 1.5 mm long, the style as long as the ovary, glabrous, receptacle cup-shaped, glabrous inside. Fruits not known. Flowers December.

Ocotea patula is named after the spreading tepals at anthesis. It is known only from two collections made on the same day in the same general area, but probably from different trees. One of the collectors indicated it was growing on a limestone substrate. It is part of the *O. helicterifolia* group and resembles *O. valeriana*. However, it differs from this species in its densely tomentellous inflorescences (with the surface entirely or almost entirely covered by the indument), by its shorter (2–3 mm vs. 6–8 mm) and tomentellous pedicels, as well as its pubescent flowers.

Paratype. COSTA RICA. **Puntarenas:** Fila Costena, *Hammel et al. 19217* (MO).

10. Ocotea praetermissa van der Werff, Novon 6: 482. 1996. TYPE: Costa Rica. Cartago: *Burger et al. 12065* (holotype, MO). Figure 12.

Ocotea praetermissa can be recognized by its alternate, rather small leaves (rarely exceeding 10 cm), paniculate inflorescences, glabrous flowers with a pubescent inner surface of the tepals, and a glabrous receptacle. It is a species of montane forests from 2000–3200 m elevation, mostly found in Costa Rica, but with a few collections from Panama. This species has been misidentified as *Ocotea* (or *Phoebe*) *pittieri* and was included in Burger and van der Werff (1990) under that name.

11. Ocotea purpurea (Mez) van der Werff, comb. nov. Basionym: *Phoebe purpurea* Mez, Jahrb. Koenigl. Bot. Gart. Berlin 5: 196. 1889. TYPE: Guatemala. Alta Verapaz, *von Tuerkheim 371* not seen (B not seen, type photograph, MO). Figure 13.

Nectandra capituliforma Lundell, Wrightia 5: 33. 1974. Syn. nov. TYPE: Guatemala. *Contreras 11235* (isotype, MO).

Ocotea purpurea is characterized by its racemose inflorescences (one or two cymes are rarely present at the base of the inflorescence), pubescent flowers, and rather small (to 11 cm), (narrowly) elliptic, flat leaves. The leaf and inflorescence characters are clearly visible on the type photograph. It is among the few species in the *O. helicterifolia* complex with racemose inflorescences and pubescent flowers; the other ones are an undescribed species from Mexico with large, obovate leaves and conspicuous domatia along the major veins, *O. corrugata* with bullate or rugose leaves, and *O. mollicella* with ascending, gray pubescence on the lower leaf surface (brown and erect in *O. purpurea*). *Ocotea purpurea* occurs in southern Mexico, Guatemala, Honduras, and Panama at altitudes ranging from 1400 to 2600 m. The name *Phoebe bourgeauviana* has frequently been applied to this species, but the type of *P. bourgeauviana* has glabrous flowers and a paniculate-cymose inflorescence.

12. Ocotea tonii (Lundell) van der Werff, comb. nov. Basionym: *Nectandra tonii* Lundell, Wrightia 4: 106. 1969. TYPE: Mexico. Chiapas: Municipio de Tenejapa, *A. Shilom Ton 2014* (isotype, NY). Figure 14.

Ocotea tonii is characterized by its narrowly elliptic, clustered leaves with short petioles, yellowish brown tomentum on the young twigs, and paniculate-cymose inflorescences with pubescent flowers. It is only known from Chiapas at altitudes between 800 and 1500 m.

13. Ocotea valeriana (Standley) W. C. Burger, Fieldiana Bot., n.s. 23: 96. 1990. *Phoebe val-*

Figures 13–16 (clockwise from top left). —13. *Ocotea purpurea*: *Breedlove 9467*. —14. *Ocotea tonii*: *Mendez Ton 5264*. —15. *Ocotea valeriana*: *Herrera et al. 475*. —16. *Ocotea valerioides*: *Grayum 3519*.

eriana Standley, Publ. Field Mus. Nat. Hist., Bot. Ser. 18(2): 460. 1937. *Cinnamomum valerianum* (Standley) Kostermans, Reinwardtia 6: 24. 1961. TYPE: Costa Rica. El Copey, *Tonduz 11746* (holotype, F not seen). Figure 15.

Nectandra austinii Allen, J. Arnold Arbor. 26: 374. 1945. Syn. nov. TYPE: Costa Rica. *Austin Smith P2226* (holotype, A not seen).

Phoebe smithii Allen, J. Arnold Arbor. 26: 317. 1945. *Cinnamomum smithianum* Kostermans, Reinwardtia 6: 23. 1961. TYPE: Costa Rica. *Austin Smith P.C. 367* (holotype, F not seen).

Ocotea valeriana resembles *O. helicterifolia* in its paniculate-cymose inflorescences, alternate leaves, glabrous flowers, and glabrous inside of the receptacles. They are best separated by the type of indument on the young twigs. In *O. valeriana* this indument consists of short, matted hairs and longer, erect hairs; usually the short, matted hairs cover the surface of the twigs completely. The indument of *O. helicterifolia* consists only of long, erect hairs, which may be densely distributed, but do not cover the surface of the twigs completely. The cupules of *O. valeriana* are also deeper than those of *O. helicterifolia*. *Ocotea valeriana* is not rare in Costa Rica and is known from a very few collections in Panama. It occurs from 800 to 2200 m. I accept the concept of *O. valeriana* used in Burger and van der Werff (1990), where W. C. Burger, who had access to the holotype, transferred *Phoebe valeriana* to *Ocotea*. Although I have not seen the types of *Nectandra austinii* and *Phoebe smithii*, I place both species in synonymy of *O. valeriana* based on the paratypes of these species I have seen (for *N. austinii*: *Austin Smith P2114* (GH); for *P. smithii*: *Austin Smith H523* (MO)).

14. Ocotea valerioides W. C. Burger, Fieldiana Bot., n.s. 23: 97. 1990. TYPE: Costa Rica. *Hartshorn 1530* (isotype, MO). Figure 16.

This species is similar to *O. lentii* in its large, obovate leaves, paniculate-cymose inflorescences, and pubescent inside of the receptacles. *Ocotea valerioides* differs in its denser indument, completely covering the surface, on the twigs and inflorescences. It is known from a few collections in Costa Rica and Panama, where it occurs in lowland rainforest between 50 and 500 m altitude.

15. Ocotea sp. nov.

This species can be readily recognized by its obovate leaves with conspicuous tufts of whitish hairs in the axils of the lateral veins and along the major veins. Its inflorescences are racemose or have secondary axes terminating in a cyme. Flowers are pubescent. A description of this species is being prepared by F. Lorea-Hernandez. The new species is only known from the state of Guerrero, Mexico.

Imperfectly Known Species

Ocotea macrophylla Kunth, Nov. Gen. Sp. 2: 131. 1818. *Nectandra macrophylla* (Kunth) Nees, Systema Laurinarum 292. 1836. TYPE: Colombia. Quindiu, *Bonpland s.n.* (isotype, P).

The type of *O. macrophylla* is a fruiting specimen; thus, flowering specimens can only be associated with this name based on vegetative similarities. Rohwer (1991) recognized several recent collections from Colombia as *O. macrophylla* and accepted *O. macrophylla* as the only species in the *O. helicterifolia* group occurring south of Panama. However, recent collections show that probably more than one species is present in northern South America; lack of sufficient flowering collections makes it impossible to accurately describe the taxa involved. All collections have alternate leaves and paniculate-cymose inflorescences.

Provisionally I distinguish the following entities:

1. *Ocotea macrophylla* sensu typi. The type collection has a rather lax, hirsute indument on the twigs, which does not completely cover the surface. The hairs on the lower leaf surface are also rather long and straight. The inflorescence or infructescence is sparsely hirsute. In addition to the type, I place here *Sanchez 1371* (MO) from Antioquia, Colombia, and *Ruiz Teran 1558* (MO), *Breteler 4928* (MO), both from Mérida, Venezuela. The Ruiz Teran specimen is a fruiting one, while the Sanchez and Breteler collections have flowers. These flowers are glabrous, even on the inside of the tepals. Anthers of the outer six stamens are sessile or nearly so.

2. *Sanchez 1891* (MO) from Antioquia, Colombia. Indument on the twigs is densely tomentellous/tomentose, covering the surface completely, as is the indument on the inflorescences. The flowers are pubescent.

3. A group of several specimens characterized by a dense, tomentellous indument on the twigs, covering the surface completely. Inflorescences are sparsely pubescent, and the flowers are glabrous or nearly so. This group occurs in Colombia (Boyaca: *Lawrance 217 & 281* (MO); Antioquia: *Fernandez 7* (MO) and *Giraldo 287* (MO); Valle: *Croat 70677* (MO) and *Albert 2451* (MO)) and Ecuador (Carchi: *Palacios 12794* (MO), and *van der Werff 10772* (MO)).

Ocotea Species, Possibly Undescribed

A few collections from Puebla (Mexico) resemble *Ocotea helicterifolia* vegetatively, but differ in having rather small flowers (only 5–6 mm diam.) and in having stamens with distinct filaments (filaments 1/3 as long as the anthers). I have not seen fruiting material of this taxon. These collections (*Rzedowski 31863*, *Tenorio 8686*, *Ventura 783*, and *Campos 225*, all in MO) may well represent an undescribed species, but I prefer to wait until more collections are at hand before describing it.

Acknowledgments. I thank the curators of CAS, F, GH, K, and TEX for the loan of specimens, B. Stannard (K) for his efforts in locating the type of *O. helicterifolia*, and T. Wendt (TEX) for duplicates of his excellent Lauraceae collections.

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List of Species Recognized

1. *Ocotea betazensis* (Mez) van der Werff
2. *Ocotea bourgeauviana* (Mez) van der Werff
3. *Ocotea congregata* van der Werff
4. *Ocotea corrugata* van der Werff
5. *Ocotea gordonii* van der Werff
6. *Ocotea helicterifolia* (Meisner) Hemsley
7. *Ocotea lentii* W. C. Burger
8. *Ocotea mollicella* (Blake) van der Werff
9. *Ocotea patula* van der Werff
10. *Ocotea praetermissa* van der Werff
11. *Ocotea purpurea* (Mez) van der Werff
12. *Ocotea tonii* (Lundell) van der Werff
13. *Ocotea valeriana* (Standley) W. C. Burger
14. *Ocotea valerioides* W. C. Burger

Specimens Studied

If collected by a team, only the last name of the first collector is listed. For example, Breedlove & Smith is included as Breedlove. Type collections are in bold face. The number in parentheses following the collector refers to the species listed above, for example, Aguilar 438 is species # 6 from the list (= *O. helicterifolia*).

Aguilar 438 (6), **2715** (9), 2819 (6); Allen 15209 (6); Almeda 3762 (10); Angulo 200 (10); Antonio 1602 (10); Aranda 1247 (11), 1261 (11), 1265 (11), 1317 (11); Austin Smith H523 (13), H679 (10), **P2114** (13).

Beaman 5402 (2); Bello 640 (13), 1977 (13), 4316 (13), 4340 (13); **Bourgeau 2234** (2); Brant 2871 (2), 2886 (11); Breedlove 6307 (12), 6969 (11), 9467 (11), 15672 (3), 21696 (6), 23329 (6), 24742 (6), 25130 (6), 27588 (6), 27637 (11), 28182 (11), 31020 (6), 31371 (6), 32107 (6), 32239 (6), 32668 (6), 32699 (6), 33017 (3), 33543 (11), 34800 (6), 35276 (6), 38043 (2), 38781 (6), 42794 (11), 44395 (6), 44411 (6), 47853 (6), 48210 (6), 49332 (6), 49348 (6), 49371 (6), 49746 (6), 50583 (2), 51313 (6), 52589 (3), 52683 (6), 52998 (6), 53010 (6), 55689 (6), 55690 (6), 57479 (6), 58528 (6), 60245 (6), 60289 (6), 66260 (6), 68637 (6), 68935 (11), 70059 (12), 72693 (11); Burger 11747 (6), **12065** (10), 12097 (13).

Cascante 644 (13); Chavarria 1153 (13); Campos 853 (6), 954 (6), 1020 (6), 1328 (6), 1877 (6), 2569 (6), 3012 (6), 3175 (6); Cedillo 667 (1), 1197 (1), 1204 (1), 1257 (1), 3060 (aff. 2), 3323 (aff. 2), 3406 (aff. 2); Chacon 1557 (13), 1634 (14); Choc 89 (6); Churchill 4326 (6), 5926 (6); Contreras 5209 (11), 11186 (2), 11205 (2), 11233 (11), **11235** (11), 11318 (11); Croat 46913 (13), 47613 (6), 64215 (6).

Davidse 28547 (10), 28551 (10), 28627 (10), 28809 (10), 28922 (10), 30477 (6), 34826 (11); Dryer 1336 (13).

Estrada 515 (14); Evans 1474 (11).

Galeotti 7004 (6); Gentry 13575 (6), 44065 (6); Gereau 2096 (1); Gomez 18814 (7), 23619 (14); Gonzalez 159 (14); Grayum 3519 (14), 8335 (6), 8870 (14); Grijalva 3705 (6).

Haber 314 (13), 5064 (13), 5591 (13), 5665 (13), 5701 (13), 5826 (13), 5998 (13), 6643 (13), 7938 (13), 8198 (13), 9155 (13), 11267 (13); von Hagen 2022 (11), 2031 (11); von Hagen 2070 (11); Hammel 7013 (10), 8534 (5), 15679 (6), 16504 (6 vel aff.), 17836 (14), 18049 (13), 19217 (9), 20062 (6), 20553 (8); Hartshorn 1463 (13), **1530** (14), 2130 (13); Hawkins 452 (11), 588A (11), 647 (11), 712 (11); Hazlett 582 (11), 1341 (6), 2516 (11); Heath 594 (6), 2033 (6); Herrera 475 (13), 3778 (13), 4866 (6), 4946 (13), 4986 (14), 5144 (14), 8938 (7); House 975 (11), 1187 (11), 1300 (11).

Ishiki 1389 (11), 1396 (11), 1488 (11), 1551 (11).

Jimenez 564 (13), 827 (13); Johnson 578 (6); Juzepczuk 1513 (12).

Kirkbride 486 (14).

Laughlin 528 (6); **Lent 794** (7), 2070 (7); **Liebmann 770/3** (1), **770/22** (1), **771/2** (1), **771/23** (1); Liesner 1789 (6); **Linden 1641** (6); Lopez L. 181 (11); Lorea 5542 (6); Lorence 4711 (1); Lot 222 (6); Lundell 18944 (11), 19425 (6), 20435 (11), 20999 (11), 21170 (11).

MacDougall H288 (6); Martinez S. 17084 (3), 20768 (6); Matuda 1887 (6), 5020 (11), 5125 (6), 5352 (11), 5375 (11), 5400 (6), 5437 (11), 6095 (6), 16224 (6); Maya 1226 (6), 1316 (6), 2094 (6), 2865 (6), 2882 (6), 2989 (6), 3081 (6), 3098 (11), 3951 (6), 3967 (6), 4176 (11), 4232 (11), 4276 (6), 4292 (11); McPherson 9259 (13), **10421** (5), 10573 (5); Meave 1314 (6); Mejia 12 (11), 256 (11), 283 (11), 294 (11), 334 (11), 379 (11); Mendez G. 7966 (6), 8503 (3), 8888 (6), **8930** (3); Mendez Ton 4214 (2), 4802 (11), 5035 (12), 5068 (11), 5264 (12), 5902 (6), 5931 (11), 9594 (3); Miller 2653 (6), 2943 (6

s.l.); Molina 203 (6), 8138 (6), 8186 (6), 11521 (6), 11769 (6), 12289 (6), 23320 (11), 24212 (11), 24289 (11), 31102 (6); Montenegro 1845 (6); Mora 110 (14), 416 (7), 508 (7); Moraga 171 (7); Morales 39 (13), 248 (13), 377 (6), 436 (10), 665 (6), 1053 (6), 4806 (10), 5812 (8), 5989 (8); Moreno 7477 (6), 8253 (6), 15427 (6), 15647 (6), 15826 (6), 15862 (6), 19376 (6), 19396B (6), 19424 (6), 21103 (6).

Nee 24906 (6), 29832 (aff. 2); Nelson 2419 (6).

Poveda 3920 (14).

Quesada 368 (6), 941 (7); Quintanilla 49 (3).

Ramirez 139 (6), 384 (6), 452 (6); Ramirez-Marcial 656 (6); Raven 19804 (6), 21630 (6); Rios 179 (7); Rivera 260 (10), 664 (6).

Sandino 2330 (6), 4706 (6); Santiz Ruiz 836 (6); **Schultes 827** (2); Shank 55 (6); **Shilom Ton 779** (6), **2014** (12), 3645 (12), **3560** (6), 7399 (11); Sinaca 777 (aff. 2); Soto 226 (6); Sousa 9337 (1); Stafford 316 (6); Standley 8044 (6), 20611 (6), 69379 (6), 69525 (6), 71446 (6), 89985 (6), 91546 (6); Stevens 17055 (6), 20397 (6), 22153 (6); Steyermark 44207 (6), 44280 (6), 44648 (6).

Taylor 4460 (10); Tenorio 3457 (12 vel aff.), 5870 (1), 11276 (1); Thorne 40325 (6); **Tonduz 11676** (8); Torres 476 (1), 494 (1), 1400 (6), 2066 (1), 2928 (1), 4832 (11), 4871 (11), 4953 (1), 4973 (1), 6598 (6), 8866 (6), 9153 (6), 10444 (6), 10830 (6), 11620 (6), 11911 (6); von Turckheim II 1651 (11), II 2164 (6).

Vazquez Torres 378 (2).

Wendt 2677 (aff. 2), 3000 (aff. 2), 3000A (aff. 2), 3861 (2), 4315 (6), 4653 (11), 4866 (11), 5137 (6), 5622 (2), **6765** (4); Wheelwright 209 (13); Williams 13888 (10), 15760 (6), 16469 (13), 20540 (6), 28623 (13), 28996 (13), 40390 (6); Wilson 40770 (6), 40859 (6).

Yncker 5777 (11).

Zamora 674 (14), 1287 (6); Zuniga 282 (6).

A New Species of *Caryodaphnopsis* (Lauraceae) from Vietnam

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ABSTRACT. *Caryodaphnopsis bilocellata* van der Werff & Dao, collected in the Cuc Phuong National Park in Vietnam and differing from the other Asian species of the genus in having 2-celled anthers, is described.

Caryodaphnopsis is a small genus of Lauraceae, characterized by its opposite leaves and strongly unequal tepals, with the outer three much smaller than the inner three. A unique wood anatomical feature of *Caryodaphnopsis* is the presence of pyramidal, trihydrate calcium oxalate crystals in the ray cells (Richter, 1981). The genus is known from Southeast Asia (southern China, Vietnam, Laos, Cambodia, Indonesia, and the Philippines) and from the Neotropics (Brazil, Peru, Ecuador, Colombia, Panama, and Costa Rica). The Asian species have been revised by Kostermans (1974), who accepted seven species. The six neotropical species were recently described or transferred to *Caryodaphnopsis* (van der Werff & Richter, 1985; van der Werff, 1986, 1988, 1991; Zamora et al., 1988), but have never been revised. Most species, including all Asian species, have nine 4-celled stamens. However, the neotropical *C. inaequalis* (A. C. Smith) van der Werff & H. G. Richter has nine 2-celled stamens, and the neotropical *C. tomentosa* van der Werff has only six 2-celled stamens. Such variation in stamen configuration within the same genus is unusual among Lauraceae, but has been reported in several genera (van der Werff & Richter, 1985). We attach more importance to the opposite leaves, strongly unequal tepals, and the wood anatomy for generic delimitation and accept the variation in stamen numbers and locelli numbers in *Caryodaphnopsis.*

During recent fieldwork in Vietnam, a species of *Caryodaphnopsis* was found that differed from the other Asian species in having nine 2-celled, and not 4-celled, stamens; its description follows here.

Caryodaphnopsis bilocellata van der Werff & Dao, sp. nov. TYPE: Vietnam. Ninh Binh Province: Cuc Phuong National Park, *H. van der Werff et al. 14250* (holotype, MO; isotypes, HN, KUN, QRS). Figure 1.

A congeneris asiaticis antheris bilocellatis recedit.

Trees, 25 m tall. Twigs terete, glabrous; terminal buds glabrous. Leaves opposite, chartaceous, elliptic or ovate-elliptic, 7–18 × 3–9 cm, glabrous on both surfaces, the base obtuse or acute, the apex acute, smaller leaves trinerved, larger leaves slightly triplinerved with the basal lateral veins leaving the midrib ca. 3 mm from above the base of the leaf, the lower surface glaucous, midrib and lateral veins slightly impressed on the upper surface, raised on the lower surface, tertiary venation immersed on both surfaces, petioles 10–14 mm long, glabrous. Inflorescences axillary, 5–15 cm long, glabrous, paniculate-cymosely branched. Flowers hermaphrodite, glabrous, green. Tepals 6, the outer 3 triangular, scale-like, ca. 0.4 mm long, the inner 3 broadly triangular, ca. 1.7 mm long, erect with the tip incurved, glabrous on the outer surface, sparsely pubescent on the inner surface; stamens 9, 2-celled, the outer 6 ca. 0.8 mm long, the filaments ca. 0.4 mm long, pubescent, the anthers glabrous, the locelli opening introrse; inner 3 stamens opening extrorse, 1 mm long, the filaments 0.3 mm long, pubescent, with 2 globose glands attached near the base of the anther; staminodia 3, ca. 0.5 mm long, dorsally pubescent, pressed against the ovary, with a triangular tip; ovary glabrous, 1 mm long, with a slender style; receptacle shallow, glabrous inside. Fruit unknown. Flowers April.

Floral measurements were taken from alcohol-preserved material, and floral size of dried flowers will be smaller (for instance, length of inner tepals 1.2 mm).

Vegetatively, *Caryodaphnopsis bilocellata* is quite similar to *C. metallica* Kostermans and *C. henryi* Airy Shaw and shares with those species the mostly

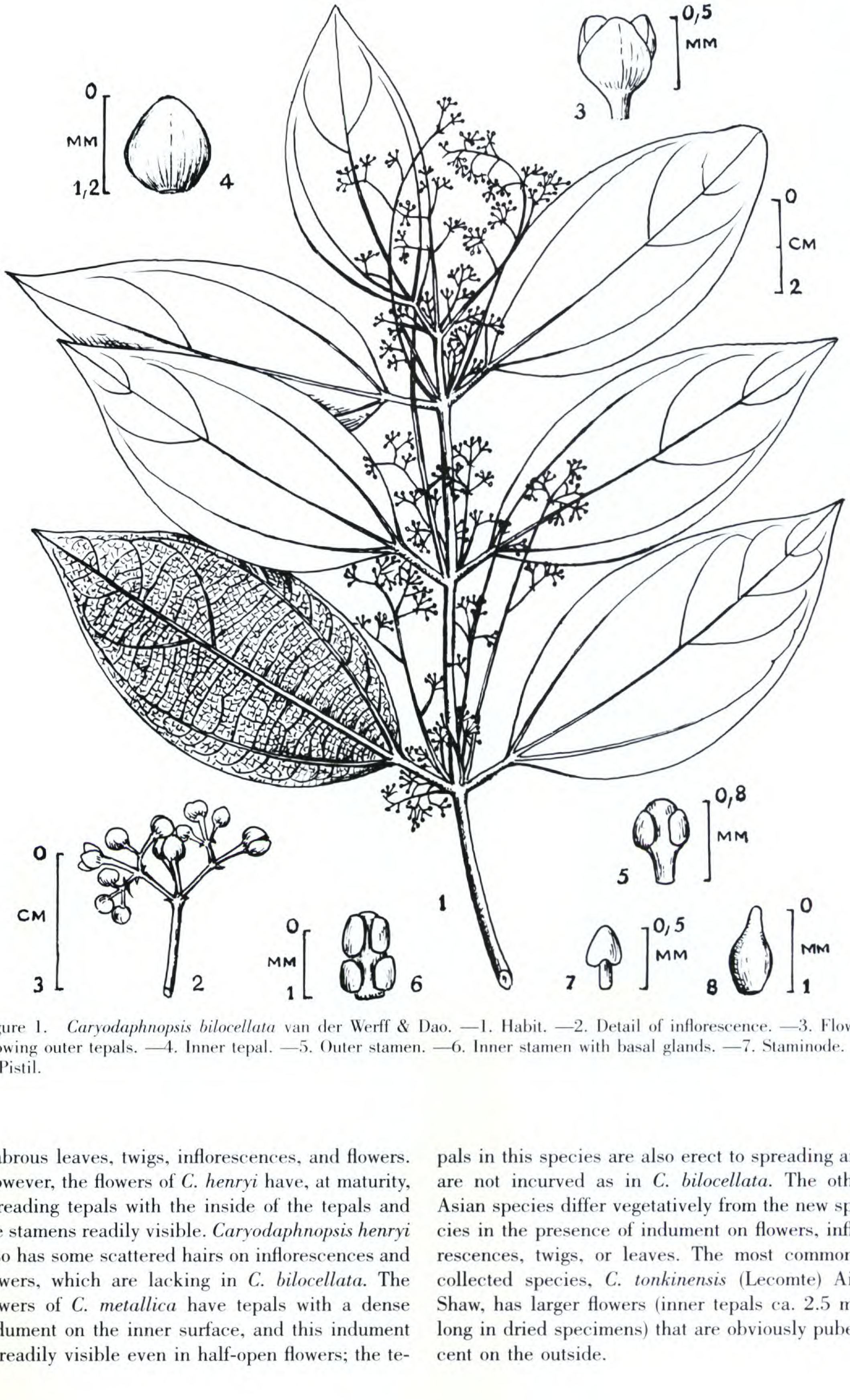

Figure 1. *Caryodaphnopsis bilocellata* van der Werff & Dao. —1. Habit. —2. Detail of inflorescence. —3. Flower showing outer tepals. —4. Inner tepal. —5. Outer stamen. —6. Inner stamen with basal glands. —7. Staminode. —8. Pistil.

glabrous leaves, twigs, inflorescences, and flowers. However, the flowers of *C. henryi* have, at maturity, spreading tepals with the inside of the tepals and the stamens readily visible. *Caryodaphnopsis henryi* also has some scattered hairs on inflorescences and flowers, which are lacking in *C. bilocellata*. The flowers of *C. metallica* have tepals with a dense indument on the inner surface, and this indument is readily visible even in half-open flowers; the tepals in this species are also erect to spreading and are not incurved as in *C. bilocellata*. The other Asian species differ vegetatively from the new species in the presence of indument on flowers, inflorescences, twigs, or leaves. The most commonly collected species, *C. tonkinensis* (Lecomte) Airy Shaw, has larger flowers (inner tepals ca. 2.5 mm long in dried specimens) that are obviously pubescent on the outside.

The only other species of *Caryodaphnopsis* with nine 2-celled stamens is the neotropical *C. inaequalis*. We do not consider this species to be a close relative of *C. bilocellata* because of differences in leaf venation (trinerved or triplinerved in *C. bilocellata*, pinnately veined in *C. inaequalis*) and distribution (northern Vietnam for *C. bilocellata*, lowland Brazil and Peru for *C. inaequalis*). We think that the reduction of 4-celled stamens to 2-celled stamens has taken place at least twice in *Caryodaphnopsis*, once in the Neotropics and once in Asia.

Paratype. VIETNAM. **Ninh Binh Province:** Cuc Phuong National Park, *van der Werff et al. 14195* (HN, MO, QRS).

Acknowledgments. Fieldwork in Vietnam was supported by National Geographic grant #5635-96. The Curator of P generously made *Caryodaphnopsis* specimens from Asia available for study. The illustration was made by the second author.

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A New Species and a New Combination in the Genus *Parodiolyra* (Poaceae: Bambusoideae: Olyreae)

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ABSTRACT. *Parodiolyra colombiensis*, endemic to eastern Colombia, is described and illustrated. It differs from the three currently recognized species of *Parodiolyra* in its pitted female lemmas and in its 3-nerved lower female glumes. Its filiform female pedicels, thickened rachilla internode between the female glumes, prolongation of the rachilla between the glume and the anthoecium, and small, awnless female spikelets are characters it shares with the previously known species of *Parodiolyra*. Because *Olyra micrantha* possesses these last four characters (except its female spikelets are awned), and in addition has a relatively short hilum, it is transferred to *Parodiolyra*. Because *P. colombiensis* and *P. micrantha* share pitted lemmas, they are believed to be more closely related to each other than to any other species in the genus *Parodiolyra*. A key to the five species of *Parodiolyra* is provided.

In 1992 Davidse received a grass specimen (*Restrepo & Matapi 467*) as part of a collection for routine identification that appeared to be an undescribed species of *Parodiolyra*. The defining characters of the genus *Parodiolyra* are (Soderstrom & Zuloaga, 1989): (1) female spikelets fall entire by disarticulating below the glumes; (2) female pedicels are filiform, not clavate; (3) a conspicuous, thickened internode is present between the lower and upper glume; (4) there is a prolongation of the rachilla between the upper glume and the anthoecium; (5) the hilum extends for only ½–¾ the length of the caryopsis, not its entire length. The *Restrepo & Matapi 467* collection had female spikelets with the first four characters. However, these spikelets were young and without caryopses, which makes it impossible to ascertain the hilum type of the new species. After consultation with Zuloaga, we decided to delay the description of the new species in the hope that we might be able to study more mature female spikelets from a new collection. In the meantime the site of the original collection was revisited early in 1999 by María Victoria Arbelaez (HUA) with the intent to re-collect this species. However, she reported (pers. comm.) that the original population had been destroyed in order to expand the airstrip. We were recently able to study duplicates of the original collection, which (although also without caryopses) were more complete and slightly more mature; this allowed us to strengthen our initial conclusions. Since this species grows in a remote area and it may be a long time before it is re-collected, it seems prudent now to report our findings. Even though some uncertainty remains about its generic classification, since we do not know its hilum type, we now name it in order to make this undoubtedly previously undescribed species available.

Parodiolyra colombiensis Davidse & Zuloaga, sp. nov. TYPE: Colombia. Caquetá: Región de Araracuara, alrededores de la pista aérea, 00.25′S, 72.30′W, 200–300 m, 11 Nov. 1991, hierba, raquillas de la infrutescencia moradas, frutos verdes, *D. Restrepo & A. Matapi 467* (holotype, COAH-017796; isotypes, COAH-020068, MO-05102566). Figures 1, 2.

Gramen perenne, monoecium; culmis superis nodis ramificantibus; laminae ovatae-lanceolatae, 8–14.5 cm longae, 1.7–3.6 cm latae, glabratae, basi asymmetricae; pseudopetioli 0.2 mm longi. Inflorescentiae paniculatae, laxae, 6–10 cm longae. Spiculae femineae ellipsoideae, 4–5 mm longae, 1.3 mm latae, glumis inter se inaequalibus; gluma infera 3-nervia, nervis tessellatis; gluma supera 5-nervia, nervis tessellatis; anthoecia ellipsoidea, 3.4 mm longa, 1.4 mm lata, excavata; lemma 5-nervium, apice pilosum; palea 2-nervia. Spiculae masculae lanceolatae, 4 mm longae, 0.7 mm latae, scabrae; lemma 3-nervium, acuminatum; palea 2-nervia, stamina 3.

Perennial monoecious herb. *Culms* branching at the upper nodes; internodes cylindrical, 3–7 cm long, rigid, hollow, glabrous; nodes shortly pubescent or glabrous, dark, compressed. *Sheaths* striate, one margin ciliate, otherwise glabrous; auricles membranous, up to 4 mm long, brownish, the mar-

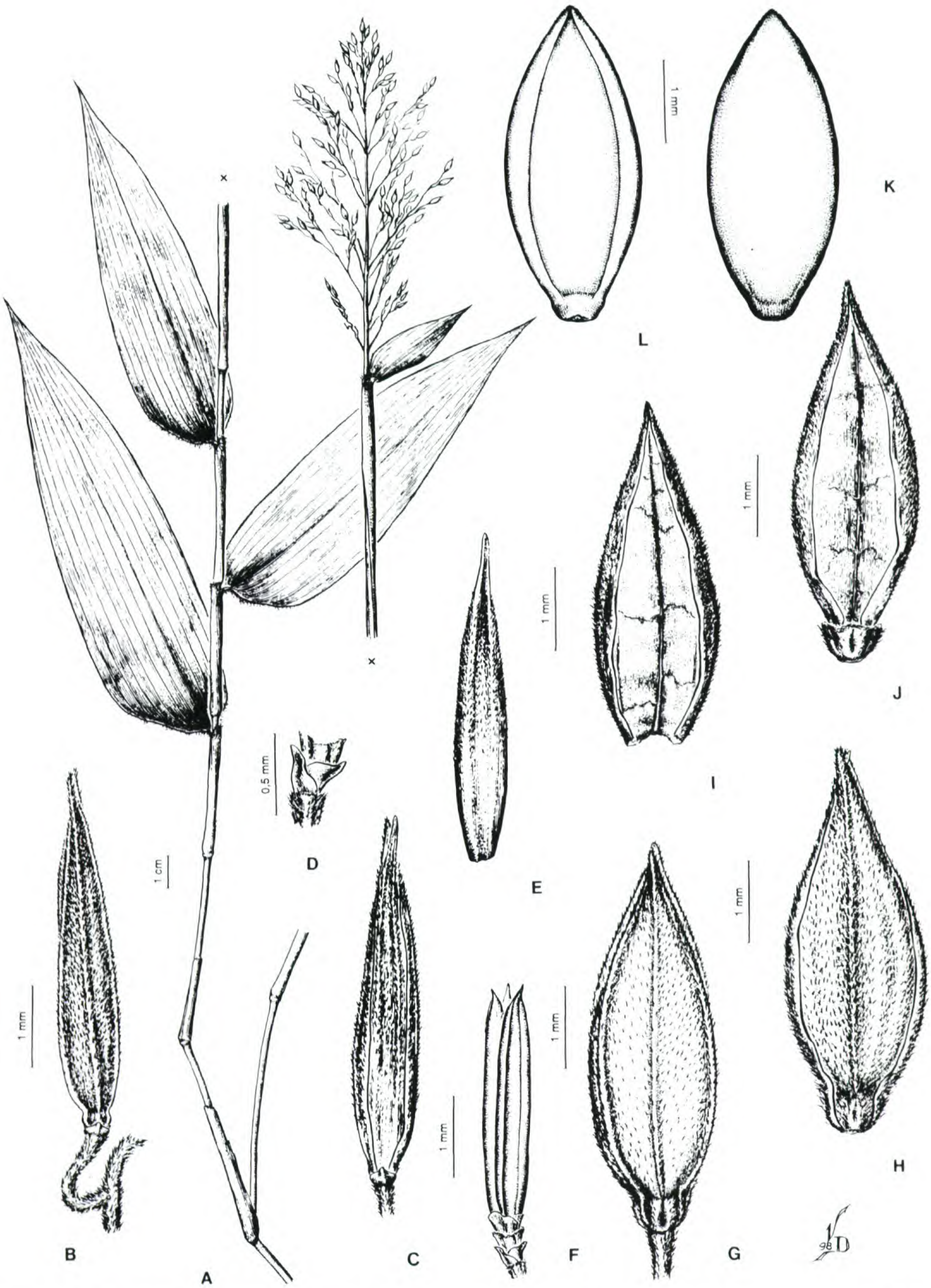

Figure 1. *Parodiolyra colombiensis* Davidse & Zuloaga. —A. Habit. —B. Male spikelet, lemma view. —C. Male spikelet, palea view. —D. Male spikelet, detail of lower and upper glume. —E. Palea of male spikelet. —F. Male flower. —G. Female spikelet, lower glume view. —H. Female spikelet, upper glume view. —I. Lower female glume, ventral view. —J. Upper female glume, ventral view. —K. Female anthoecium, dorsal view. —L. Female anthoecium, ventral view. (*Restrepo & Matapi 467.*)

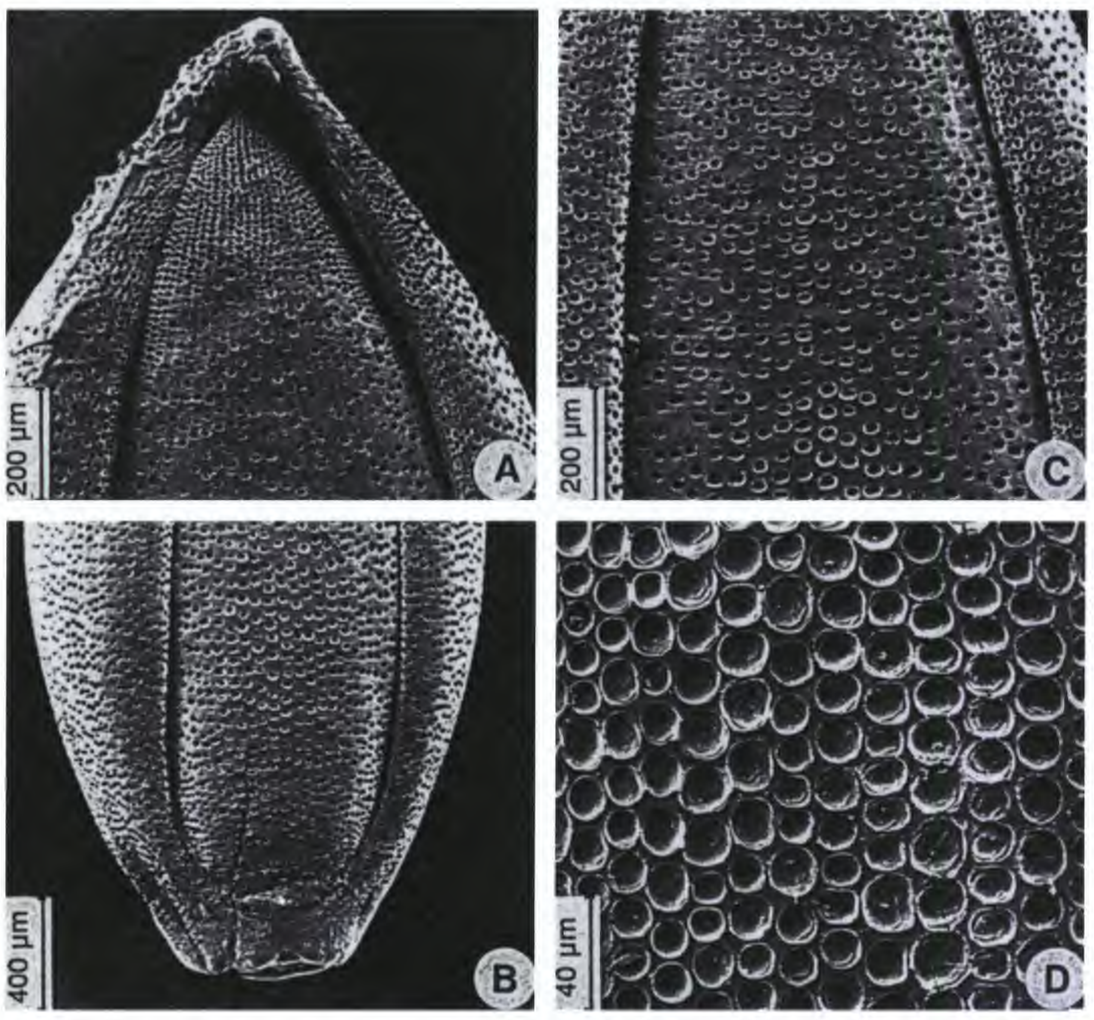

Figure 2. Detail of the female anthoecium of *Parodiolyra colombiensis*. —A. Apex of pitted lemma and palea, lemma with bottle-like microhairs. —B. Detail of base. —C. Middle portion of palea and borders of the lemma. —D. Detail of pitted area in the apical portion of the palea. (*Restrepo & Matapi 467.*)

gins ciliate. *Ligules* small, membranous-ciliate. *Blades* ovate-lanceolate, 8–14.5 cm long, 1.7–3.6 cm wide, flat, basally truncate and asymmetric, the apex acuminate, the lower margins ciliate or glabrous, otherwise scabrous, glabrous on the rest of its surface; pseudopetiole brownish, ca. 0.2 mm long, the adaxial surface densely pilose, the abaxial surface glabrous. *Inflorescence* a panicle 6–10 cm long, lax and open, terminal and exserted, sometimes with one additional, axillary, slightly smaller, partially exserted panicle; branches 1–6 per node, the uppermost branches bearing only female spikelets, the branches in the lower half of the panicle bearing both female and male spikelets, with the male spikelets borne below the female spikelets toward the base of the branches, the lowest branch sometimes bearing only male spikelets; *main axis* terete, scaberulous or sparsely hispid, purplish, the axis of the branches smooth, glabrous or sparsely hispid; pedicels of the male and female spikelets similar, not thickened, scaberulous, 1.5–7 mm long, purplish. *Female spikelets* narrowly ellipsoid, 4–5 mm long, 1.3 mm wide, disarticulating below the glumes; lower and upper glumes subequal, acuminate, with a 0.6-mm-long, thickened internode between them. *Lower glume* 4–5 mm long, scabrous on the outer surface and toward the apex of the inner surface, 3-nerved, the nerves anastomosing. *Upper glume* 4.2–4.6 mm long, scabrous on the outer surface and toward the apex on the inner surface, 5-nerved, the nerves anastomosing. *Rachilla internode* between the upper glume and anthoecium somewhat elongated and slender (a stipe). *Anthoecium* ellipsoid, 3.4 mm long, 1.4 mm wide, shorter than the lower and upper glume, indurated, stramineous, pitted, with rounded excavations over the entire surface, the lemma with conspicuous bottle-like microhairs at the apex, 5-nerved; lodicules 3, truncate, 0.4 mm long. *Caryopsis* unknown. *Male spikelets* lanceolate, 4 mm long, 0.7 mm wide, purplish, with 2 small glumes at the base; lemma 3-nerved, acuminate, scabrous; palea 2-nerved, scabrous; stamens 3, the anthers 2.3–3 mm long.

The species is only known from the type collection. The Araracuara region lies in an area of low sandstone mesas in southeastern Colombia. This area has a mosaic of vegetation types and has not been well collected.

The size of the plant is not known. It probably has erect, self-supporting culms, but notes on its habit are not available.

Although male spikelets of the Olyreae typically lack glumes, the occasional occurrence of rudimentary glumes has been also reported in *P. lateralis* (J. Presl ex Nees) Soderstrom & Zuloaga by Soderstrom and Zuloaga (1989).

The characteristic bottle-like microhairs present at the apex of the female lemma in *P. colombiensis* are also conspicuous in both *P. luetzelburgii* and *P. ramosissima*.

Excluding the unknown hilum character, *P. colombiensis* differs from the three currently recognized species of *Parodiolyra* in having a female lemma surface pitted with round excavations, rather than entirely smooth; however, all four species have some pitting on the female palea. In *P. lateralis*, *P. luetzelburgii* (Pilger) Soderstrom & Zuloaga, and *P. ramosissima* (Trinius) Soderstrom & Zuloaga, the pits are restricted to the base and the apex, whereas the palea is uniformly pitted in *P. colombiensis*. In this respect *P. colombiensis* is similar to *Olyra micrantha* Kunth, a widespread South American species. However, they clearly differ from each other by the characters listed in Table 1. *Olyra* is polymorphic for pitted anthoecia. Excluding *O. micrantha*, 9 of the 23 currently recognized species of *Olyra* possess pitted female anthoecia, while the remainder have entirely smooth anthoecia.

Soderstrom and Zuloaga (1989) had already noted that *O. micrantha* is atypical in *Olyra* because its female spikelets disarticulate below the glumes, the pedicels of the female spikelets are slender at the apex, not thickened, and its glumes are separated by a conspicuous internode in female spikelets. We have observed that there are two disarticulation points in the female spikelet of *O.*

Table 1. Comparison of the five recognized species of *Parodiolyra*.

	P. luetzelburgii	*P. ramosissima*	*P. colombiensis*	*P. micrantha*	*P. lateralis*
Female spikelets (mm)	3–3.6	5–5.8	4.5–5	5.4–12.8	2–2.6
Awn development	unawned	unawned	unawned	awned	unawned
Lower glume	7–9-nerved	7–9-nerved	3-nerved	5-nerved	5–7-nerved
Upper glume	5–7-nerved	5–6-nerved	5-nerved	3–5-nerved	5–7-nerved
Lemma	smooth	smooth	pitted	pitted	smooth
Palea	pitted toward the apex and base	pitted toward the apex and base	pitted throughout	pitted throughout	pitted toward the apex and base
Microhairs	+	+	+	+	−
Male spikelets (mm)	4.1–5.1	3.5–4.3	4	7.4–9.3	3–4
Male spikelets, glumes	−	−	+	−	+
Distribution	Guianas, N Brazil, Venezuela	E Brazil	Colombia	South America	Central and South America
Blades (cm)	8–11 × 1.6–3.1	3.6–13 × 0.9–1.7	8–14 × 1.7–3.6	13–32(–55) × 2.4–11.5	2–5 × 0.5–1.3
Inflorescence (cm)	5–8	3–8	6–10	10–32	1.2–3

micrantha, one below the anthoecium and the other one below the glumes. Female spikelets without a developed caryopsis disarticulate below the glumes, although not as readily as in *P. colombiensis* (as judged from herbarium specimens). However, in female spikelets with mature caryopses, the anthoecium disarticulates leaving behind the empty, somewhat persistent glumes.

Olyra species tend to have relatively large female spikelets and *Parodiolyra* small ones. Comparing their spikelet size by means of female anthoecia (since that eliminates having to deal with awns, which tend to be highly variable in length within the same species), *Olyra* species range from 5.5 mm in *O. wurdackii* Swallen and *O. latispicula* Soderstrom & Zuloaga to 15.8 mm in *O. holttumiana* Soderstrom & Zuloaga. In *Parodiolyra* female anthoecia vary from 1.9 mm in *P. luetzelburgii* to 3.3 mm in *P. ramosissima* (Soderstrom & Zuloaga, 1989). The female anthoecia of *O. micrantha* (2.8–3.5 mm) and *P. colombiensis* (3.4 mm) fall within the range of *Parodiolyra*. It seems likely that the thickened female pedicels of *Olyra* species are functionally related to their larger spikelets, especially since their much smaller male spikelets have slender pedicels, similar to the slender female and male pedicels of *Parodiolyra*.

Soderstrom and Zuloaga (1989) did not investigate the hilum type of *O. micrantha* as an aid in the elucidation of the taxonomic position of this species. We have done so now, and the hilum is approximately ⅗–⅘ as long as the caryopsis (Venezuela: *Davidse & Huber 22984*, *Davidse et al. 18746*; Paraguay: *Zardini & Guard 15512*, *Zardini & Velásquez 15757*, *Zardini & Aguayo 15842*, all MO). In contrast, in all other *Olyra* species the hilum is approximately as long as the caryopsis.

On the basis of all these characters, it seems more consistent to include *O. micrantha* in *Parodiolyra*, and we make this transfer here. Primarily because they share pitted female lemmas, *P. micrantha* and *P. colombiensis* are probably more closely related to each other than to any other species in the genus.

Parodiolyra micrantha (Kunth) Davidse & Zuloaga, comb. nov. Basionym: *Olyra micrantha* Kunth, in Humboldt, Bonpland & Kunth, Nov. Gen. Sp. 1: 199. 1816. TYPE: Venezuela. Amazonas: Maypures rapids of the Orinoco River, *Humboldt & Bonpland s.n.* (holotype, P; microfiche, fragment US-2877940).

KEY TO THE SPECIES OF *PARODIOLYRA*

1a. Female and male spikelets awned; male spike-

lets 7.4–9.3 mm long; blades 13–32 cm long; inflorescence 10–32 cm long . . . . . *P. micrantha*

1b. Female and male spikelets without awns; male spikelets 3.5–5.1 mm long; blades 2.5–14 cm long; inflorescence 3–10 cm long.

2a. Lemma of female spikelets pitted; lower glume of female spikelets 3-nerved . . . . . *P. colombiensis*

2b. Lemma of female spikelets smooth; lower glume of female spikelets 5–9-nerved.

3a. Female spikelets 2–2.6 mm long, black at maturity; female lemma glabrous, obtuse; leaf blades 2.5–5 cm long . . . . . *P. lateralis*

3b. Female spikelets 3–5.8 mm long, light-colored at maturity; female lemma with conspicuous bicellular microhairs at the apex, acute; leaf blades 4–13 cm long.

4a. Female spikelets 3–3.6 mm long, 1.5–1.7 mm wide; male spikelets 4.1–5.1 mm long; panicles with the lower branches whorled; ovary glabrous; lower margins of the blades long-ciliate . . . . . *P. luetzelburgii*

4b. Female spikelets 5–5.8 mm long, 1.9–2.8 mm wide; male spikelets 3.5–4.3 mm long; panicles with the lower branches alternate or opposite; ovary pilose toward the summit; lower margins of the blades glabrous or scabrous, not ciliate . . . . . *P. ramosissima*

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Note

Rogers McVaugh—A Protest

For 90 years my name has been Rogers McVaugh, not one letter more nor less. It was my mother's wish that I be given a distinctive name, uncluttered by a middle name that would never be used. As a small boy I was proud of it because it put me on a par with my father, whose name was Roy McVaugh. In later life I have enjoyed it, and have fought off the rather frequent attempts by acquaintances to change it to "Roger" or "Rodgers." Now it seems the time has come to admonish those who wish to add something to a name that is already long enough. I am not averse to seeing my name in print, but I object to having it changed by those who should know better, namely editors who have not done their homework carefully enough.

The ultimate indignity surfaced not long ago, in the recently published history of the American Society of Plant Taxonomists (Schofield, 1998). There my likeness appeared on page 30 above the name of "Rogers M. McVaugh," thus basely excluding me from the elite group of my compeers, LeRoy Abrams, Lincoln Constance, and Robert Ornduff, who "had no middle initials" (ibid. page 32).

The seed of this gratuitous "M." seems to have been planted (appropriately enough) in *Hortus Third* (New York: Macmillan, 1976: 1199), where my name appeared in the list of "Authors cited" as "Michael Rogers McVaugh (1909)." The date of birth is mine, of course, but the name? Doubtless the editor had somehow (how in the world?) confused my name with that of the real Michael Rogers McVaugh (born 1938), who is not a professional botanist but an eminent historian of medieval medicine, who might even be embarrassed at seeing his name linked so closely with the nomenclature of the Spermatophytes.

The seed in the "Third Garden" grew and underwent some metamorphoses before it was brought again to public notice in a world catalog of the published names in the genus *Euphorbia* and its close relatives (Oudejans, 1990). The Euphorbiaceous names for which I had been responsible were duly listed, with the author reported as "[M.] R. McVaugh." The implication seemed to be that I had been clandestinely suppressing my proper given name through all these many years and many publications, until at last it could be corrected for all to see.

It is still not clear to me how the "M." came to be moved from the front of the name in 1990 to the middle of the name in 1998. However that may be, I disclaim the "M." without any reservation! I repudiate it utterly, whether it be naked or bracketed, initial or medial. I hope and expect to live the rest of my life as the holotype of an unqualified and unique binomial.

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